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CONTENTS OF VOLUME XXX.

No. 3.

PAGE

The Mammals and Birds of Kashmir and the Adjacent Hill Provinces. Part IV. (*With a plate and 11 text figures.*) By Col. A. E. Ward 509

Bombay Natural History Society's Mammal Survey of India, Burma and Ceylon. Report No. 37 (*a*), Nepal. By T. B. Fry 525

Early Stages in the Development of some Fresh Water Fishes in the Punjab. (*With 3 plates.*) By M. Hamid Khan, M.SC., F.R.M.S. 531

The Cremastogaster Ant. (*With a plate.*) By Major R. W. G. Hingston, I.M.S. 541

Some New Alpine Grasshoppers of the Genus *Conophyma* Zub., from Central Asia. By B. P. Uvarov, F.E.S. 551

The Common Butterflies of the Plains of India. Part XXXIV. (*With a text figure.*) By T. R. Bell, C.I.E., I.F.S. (Retd.) 561

Two New Burmese Snakes. (*With a plate.*) By Col. F. Wall, I.M.S., ETC. 587

Notes on Charophytes from Gonda, U. P. (*With 5 plates.*) By G. O. Allen, I.C.S. 589

Bird's Nesting with a Camera in India. Part IV. (*With 6 plates.*) By Capt. R. S. P. Bates 600

The Identification of Indian Butterflies. Part VII. (*With plates.*) By Col. W. H. Evans, D.S.O., F.Z.S., F.E.S. 610

Notes and Description of Indian Fishes. Part III. By H. W. Fowler 640

An Encounter with a Fighting Tiger. (*With a photo.*) By Col. R. W. Burton, I.A. (Retd.) 652

Indian Dragonflies. Part XXI. (*With 1 plate and 1 text figure.*) By Major F. C. Fraser, I.M.S., F.E.S. 657

Notes on the Birds of the Sikkim Himalayas. Part VI. (*With a plate.*) By Herbert Stevens, M.B.O.U. 664

PAGE

REVIEWS—IN THE HIGHER HIMALAYAS. By H. Whistler, F.Z.S. ... 686
A GENERAL TEXT BOOK OF ENTOMOLOGY. By A. D. Imms ... 687

EDITORIAL ... 689

MISCELLANEOUS NOTES :—

I. Breeding season of the Nilgiri Langur. By Rev. C. Leigh, S.J. ... 691
II. Wild Dogs and Jungle Tragedies. By R. C. Morris ... 691
III. 'Wild Animals of Central India.' By R. C. Morris (with a Note by A. A. Dunbar Brander) 694
IV. A Black Jackal. By M. S. Tuggerse ... 698
V. The Record Sind Wild Goat. (*Capra hircus blythi.*) (*With a plate.*) By R. L. McCulloch... 699
VI. The Allied Grosbeak (*Perrisospiza affinis* Blyth). By H. Whistler, F.L.S., F.Z.S. ... 701
VII. On the breeding of the Indian Tree Pipit (*Anthus hodgsoni*) in Kulu. By H. Whistler, F.L.S., F.Z.S. 701
VIII. The Cotton Teal. By Sir Harcourt Butler ... 702
IX. Occurrence of the Scaup Duck (*Fuligula marila*) in Northern India. By S. H. Prater, C.M.Z.S.... 703
X. The length attained by and the habits of the Ghavial (*G. gangeticus.*) By Major C. R. S. Pitman... 703
XI. Boa Constrictor *vs.* Alligator. (*With a photo.*) By Editors... 704
XII. Tiger killed by a Cobra. (*With a photo.*) By Editors... 705
XIII. Record of a death from bite of the Hamadryad or King Cobra (*Naia hanna.*) By C. Theobald, F.Z.S... 706
XIV. Recovery from the bite of *Echis carinata.* By Capt. H. J. Rice, I.M.S... 706
XV. Viper and White Throat. By B. B. Osmaston, I.F.S. (Retd.) ... 707
XVI. A List of Fishes obtained in the Saran District, Bihar, chiefly from the Ghogra River, near the town of Chapra and in its vicinity. By E. A. D'Abreu, F.Z.S. ... 707

PAGE
XVII. The Occurrence of the Spiny-Eel. By E. A. D'Abreu, F.Z.S. 711
XVIII. Formula for estimating weight of Mahseer. By Major W. B. Trevenen 711
XIX. The Ceylon Races of *Terias blanda* Bdv., and *sari*, Horsf. By H. T. G. Watkins 714
PROCEEDINGS 715

No. 4.

THE MAMMALS AND BIRDS OF KASHMIR AND THE ADJACENT HILL PROVINCES. Part V. (*With a plate and 3 text figures.*) By Colonel A. E. Ward 719
BIRDS OF THE PERSIAN GULF ISLANDS. (*With 4 plates and a Map.*) By Dr. C. B. Ticehurst, M.A., M.R.C.S., M.B.O.U., Major-General Sir Percy Z. Cox, G.C.M.G., G.C.I.E., K.C.S.I., M.B.O.U. and Major R. E. Cheesman, M.B.O.U., F.R.G.S. 725
NEW SNAKE FROM BURMA. By Col. F. Wall, C.M.G., K.H.S. 734
AN ORIENTAL HUNTING WASP (*Sphex lobatus.*) By Major R. W. G. Hingston, I.M.S. 735
AN ACCOUNT OF SOME FRESH WATER CILIATES FROM LAHORE. (*With 2 plates.*) By Amar Nath Gulati, M.S.C. 744
THE IDENTIFICATION OF INDIAN BUTTERFLIES. Part VIII. (*With a plate.*) By Col. W. H. Evans, D.S.O., F.Z.S., F.E.S. 756
ON THE ANTIQUITY AND THE THERAPEUTIC USES OF THE INDIAN SPIKENARD. (*With a plate.*) By S. C. Sinha, M.A. 777
TWO NEW THYSANOPTERA FROM SOUTH INDIA. (*With a plate and a text figure.*) By T. V. Ramakrishna Iyer ... 788
BIRDS NESTING WITH A CAMERA IN INDIA. Part V. (*With 5 plates.*) By Capt. R. S. P. Bates.......... 793
NOTES ON SNAKES COLLECTED IN BURMA IN 1924. By Col. F. Wall, C.M.G., K.H.S. 805
THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA. Part XXXV. By T. R. Bell, C.I.E., I.F.S. (Retd.) 822
A FEW DAYS AFTER URIAL IN THE PUNJAB. By Lt.-Col. R. W. Burton, I.A. (Retd.) 838
INDIAN DRAGONFLIES. Part XXII. (*With a plate and 10 text figures.*) By Major F. C. Fraser, I.M.S., F.E.S.......... 846

PAGE

Notes on a Nest of the Common Indian Hornet. (*With a plate.*) By B. Chopra, D.SC. 858

An Annotated List of the Thysanoptera known from India and Ceylon. By T. V. Ramakrishna Iyer. 861

Notes on the Birds of Sikkim Himalayas. Part VII (*Conclusion*) (*With 2 plates.*) By Herbert Stevens, M.B.O.U. 872

Reviews :—The Protection of Birds. By Lewis R. W. Loyd 894

A Monograph of the Birds of Prey. Part I. By H. Kirke Swann, F.Z.S., M.B.O.U. 894

Nature at the Desert's Edge. By R. W. G. Hingston, M.C., M.B., I.M.S. 896

Familiar Flowering Trees in India. By Ida Colthurst.. 898

Obituaries :—Prof. H. M. Maxwell Lefroy; Prof. F. Hallberg; Mr. L. J. Sedgwick, I.C.S............ 899

Editorial 902

Miscellaneous Notes :—

I. The Slow Loris. By Major J. D. Scale 904

II. The Occurrence of Hodgson's Bat. By E. A. D'Abreu, F.Z.S. 905

III. The 'Sambhar Call' of the Tiger. By A. A. Dunbar Brander 905

IV. Tiger-netting in Assam. By L. J. Delanougerede, D.F.O. 907

V. Panther with abnormal feet. By Maharaj Kumar Shree Vijayarajji 909

VI. Abnormal Clavicle Bones of a Tiger. By Lt.-Col. W. G. Hutchinson 910

VII. Panther and Wild Dogs. By Lt.-Col. R. W. Burton 910

VIII. A Hybrid Black Buck and Chinkara. (*With a photo.*) By Maharaj Kumar Sri Sadul Singhji Bahadur. 911

IX. Duel between two Bull Elephants. By H. F. Mooney, I.F.S.. 912

X. An Elephant Trap. By C. G. Seligman 912

XI. Crow's Nests and Electric Cables. By S. H. Prater, C.M.Z.S. 913

PAGE
XII. Predatory Habits of the Magpie. By Lt.-Col. F. M. Bailey ... 914
XIII. Fresh Light on the Identity of the 'Devil Bird.' By Editors ... 914
XIV. Hawks and Swallows. By Major J. D. Scales, D.S.O., O.B.E. ... 915
XV. An Albino Hoopoe. (*With a photo.*) By Mrs. H. K. Rudkin ... 916
XVI. Occurrence of the Nepal Kalij Pheasant at Mussoorie. By F. Field ... 917
XVII. Breeding of the Painted Sand-Grouse in the Punjab Salt Range. By H. W. Waite, F.Z.S., M.B.O.U. ... 917
XVIII. The Nesting of the Little Green Heron in the District of 24-Pergannas. (*With a photo.*) By Satya Churn Law ... 918
XIX. Weights of Woodcock in Shillong. By Lt.-Col. G. R. Row, I.A. (Retd.) ... 919
XX. Records with Snipe. By Udaji Rao Puar ... 920
XXI. The Snake *Natrix venningi* (Venning's Keelback.) By Lt.-Col. F. Wall ... 921
XXII. The Common 'Fire Fishes' of Madras. By S. T. Moses ... 921
XXIII. A Run of Fish on the Streams falling into the Yamdrok Tso. By Lt.-Col. F. M. Bailey ... 922
XXIV. Extraordinary Display of '*Leucodice soracte*' of the Genus 'APORIA.' (*With a plate.*) By R. Y. A. Morshead ... 923
XXV. *Captosoma ostensum*, Dist. and its enemy *Synia melanaria*, Muls. By T. V. Subramanyam, B.A. ... 924
PROCEEDINGS ... 926

ALPHABETICAL LIST OF CONTRIBUTORS

VOLUME XXX

Page

Aiyar, T. V. Ramakrishna ; Two new *Thysanoptera* from South India (*with 1 plate and 1 text figure*) 788

———; An annotated List of the *Thysanoptera* known from India and Ceylon ... 861

Allen, G. O., I.C.S. ; Notes on Charophytes from Gonda, U. P. (*with 5 plates*) 589

Bahadur, Maharaj Kumar Sri Sadul Singhji ; A Hybrid Black Buck (*A. cervicapra*) and chinkara (*G. bennetti*) (*with a photo*) 911

Bailey, Lt.-Col. F. M. ; Predatory Habits of the Magpie ... 914

———A run of Fish on the streams falling into the Yamdrok Tso 922

Bates, Capt. R. S. P. ; Birds nesting with a camera in India—
  Part IV. (*with 6 plates*) ... 600
  Part V. (*with 5 plates*) ... 793

Bell, T. R., C. I. E., I. F. S. (Retd.) ; The Common Butterflies of the plains of India—
  Part XXXIV (*with 1 text figure*) 561
  Part XXXV 822

Bombay Natural History Society's Mammal Survey No. 37(a) Nepal 525

Brander, A. Dunbar ; Comments on Wild Animals of Central India 696

———; The Sambhar Call of Tiger ... 905

Burton, Lt.-Col. R. W., I. A. (Retd.) ; An encounter with a fighting Tiger (*with a photo*) ... 652

Page

Burton, Lt.-Col. R. W., I. A. (Retd.) Panther and Wild Dogs. 910

Butler, Harcourt ; The Cotton Teal 702

Cheesman, Major R. E., *see* Ticehurst, Dr. C. B.

Chopra, B., D.Sc.; Note on a nest of the Common Indian Hornet (*Vespa cincta*, Fabr.) (*with a plate*) 858

Cox, Major-General Sir Percy Z. ; *see* Ticehurst, Dr. C. B.

D'Abreu, E. A., F.Z.S. A List of Fish obtained in the Saran District, Behar, chiefly from the Ghogra River, near the town of Chapra and in its vicinity 707

———; Formula for estimating weight of Mahseer ... 711

———; The occurrence of Hodgson's Bat (*Myotis formosus*) in the Central Provinces ... 905

Delanougerede, L. J., D.F.O.; Tiger-netting in Assam (*with 1 plate and 2 text figures*) ... 907

Editors ; Boa Constrictor *vs.* Alligator (*with a text figure*) ... 704

———; Tiger killed by a Cobra (*with a text figure*) ... 705

———; Fresh light on the identity of the 'Devil Bird' ... 914

Evans, Colonel W. H., D.S.O., F.Z.S., F.E.S. ; The Identification of Indian Butterflies—
  Part VII (*with 1 plate*) ... 610
  Part VIII (*with 1 plate*) ... 756

Field, F. ; Occurrence of the Nepal Kalij Pheasant (*G. leucomelanus*) at Mussoorie ... 917

PAGE

Fowler, Henry W. ; Notes and Descriptions of Indian Fishes—Part III 640

Fraser, Major F. C., I.M.S., F.E.S. ; Indian Dragonflies, Part XXI (*with 1 plate and 1 text figure*) 657

———— ; Indian Dragonflies (*with 1 plate and 3 text figures*). 846

Fry, T. B., *see* Bombay Natural History Society's Mammal Survey of India, Burmah and Ceylon 525

Gulati, Amar Nath, M.Sc. ; An account of some Fresh-Water Ciliates from Lahore ... 744

Hingston, Major R. W. G., I.M.S. ; The Cremastogaster Ant (*with a plate*) 541

———— ; An Oriental Hunting Wasp. (*Sphex lobatus*) Part I 735

Hutchinson, Lt.-Col. W. G. ; Abnormal Clavicle Bones of a Tiger 910

Khan, M. Hamid, M. Sc., F.R.M.S. ; Early Stages in the Development of some Freshwater Fishes in the Punjab (*with 3 plates*) 531

Law, Satya Churn ; The nesting of the Little Green Heron (*Butorides striatus javanica*) in the District of 24-Pergannas (*with a photo*) 918

Leigh, C. S. J. ; Breeding season of the Nilgiri Langur ... 691

McCullouh, R. L. ; A Record Sind Wild Goat (*with 1 plate*). 699

Mooney, H. F., I.F.S. ; Duel between two Bull Elephants ... 912

Moore, J. Percy ; Wanted : Information on Indian Leeches ... 925

Morris, R. C. ; Wild Dogs and Jungle Tragedies 691

———— ; Wild Animals of Central India 694

Morshead, R. Y. A. ; Extraordinary Display of '*Leucodice soracte*' of the genus (*Aporiá*) (*with a plate*) 923

PAGE

Moses, S. T. ; Two Common 'Fire-Fishes' of Madras (*Pterois russellii*, Van Hass.) and (*P. volitans*, Linn.) A preliminary note on their variations. 921

Osmaston, B. B., I.F.S. (Retd.) ; Viper and White-throat ... 707

Pitman, Major C. R. S. ; The length attained by and the habits of the Gahrial 703

Prater, S. H., C.M.Z.S.; Occurrence of the Scaup Duck (*Fuligula marila*) in Northern India 703

———— ; Crows Nests and Electric Cables 913

Puar, Udaji Rao ; Records with Snipe 920

Rice, Capt. H. J., I.M.S. ; Recovery from the bite of *Echis carinata* 706

Row, Lt.-Col. T. A. (Retd.) ; Weights of Woodcock in Shillong 919

Rudkin, Mrs. H. K. ; An Albino Hoopoe (*Upupa epops indica*) (*with a photo*) 916

Scale, Major J. D. ; The Slow Loris (*Nycticebus coucang*) ... 904

Scales, Major J. D., D.S.O., O.B.E. ; Hawks and Swallows. 915

Seligman, C. G. ; An Elephant Trap 912

Sinha, S. C. On the Antiquity and the Therapeutic uses of the Indian Spikenard (*with a plate*) 777

Stevens, Herbert, M.B.O.U.; Notes on the Birds of the Sikkim Himalayas—
  Part VI. (*with 2 plates*) ... 664
  Part VII (*conclusion*) (*with 2 plates*) 872

Subramanyam, T. V., B.A. ; *Coptosoma ostensum* Dist. and its enemy *Syniá melanaria*, Muls. (*with 1 plate*) ... 924

Theobald, Charles, F.Z.S., Record of a death from a bite of the Hamadryad or King Cobra (*Naia hanna*) 706

PAGE

TICEHURST, Dr. C. B., M.R.C.S., M. B.O.U., Cox, Major-General Sir Percy, Z., G.C.M.G., G.C.I.E., K.C.S.I, M.B.O.U., and Cheesman, Major, R. E., M.B.O.U. Birds of the Persian Gulf Islands (*with 4 plates and a map*) 725

TUGGERSE, M. S.; Black Jackal. 698

UVAROV, B. P., F.E.S., Some new Alpine Grasshoppers of the genus *Conophyma*, Zub. from Central Asia 551

VIJAYARAJJI, MAHARAJ KUMAR SHREE ; Panther with abnormal feet 909

WAITE, H.W., F.Z.S., M.B.O.U.; Breeding of the Painted Sand-Grouse (*Pterocles indicus*) in the Panjab Salt Range 917

WALL, COLONEL F., C.M.G., K.H.S., I.M.S. Two new Burmese Snakes (*with 1 plate*). 587

WALL, COLONEL F., C.M.G., K.H.S., I.M.S., A new snake from Burma 734

———— ; Notes on Snakes collected in Burma in 1924 ... 805

———— ; The Snake *Natrix venningi* (Venning's Keelback) a correction 921

WARD, COL. A. E. ; The Mammals and Birds of Kashmir and adjacent Hill Provinces—

Part IV (*with 1 plate and 11 text figures*)... 509

Part V (*with 1 plate and 3 text figures*) 719

WATKINS, H. T. G.; The Ceylon races of *Terias blanda*, Bdv., and *sari*, Horsf. 714

WHISTLER, HUGH, F. Z. S.; The allied Grosbeak (*Perissospiza affinis*, Blyth) 700

———— ; On the Breeding of the Indian Tree Pipit (*Anthus hodgsoni*) in Kulu 701

LIST OF PLATES

VOLUME XXX

No. 3

PAGE

The Mammals and Birds of Kashmir and the adjacent Hill Provinces—

Tibetan Antelope (*Panthalops hodgsoni*) 509

Early Stages in the Development of some Fresh Water Fishes in the Punjab—

Plate I—*Ophiocephalus marulius* 532
Plate II—*Wallago attu* 533
Plate III—*Labeo gonius* 536

The Cremastogaster Ant (*C. auberti*) 541

Two New Burmese Snakes—

(A) *Natrix nigriventer* 587
(B) *Natrix gilhodesi* 587

Charophytes from Gonda. U.P.—

Plate I—Fig. 1. *Chara brachypus* 590
Fig. 2. *Triplostichous* 590
Fig. 3. *Diplostichous* 590
Plate II—Fig. 1. *Nitella amminata* 596
Fig. 2. ,, *mirabilis* 596
Plate III—*Chara braunii* 597
Plate IV—*Chara wallichii* 598
Plate V—Chart 599

Birds Nesting with a Camera in India—

Plate I—(A) The Indian Great Reed-Warbler (*Acrocephalus stentoreus brunnescens*) 600
(B) The Paddy-Field Warbler (*Acrocephalus agricolus*)... 600
Plate II—(A) The Common Coot (*Fulica atra atra*) 601
(B) The Central Asian Kingfisher (*Alcedo atthis pallasii*) 601
(C) The Pheasant-tailed Jacana (*Hydrophasianus chirurgus*) 601
Plate III—(A) The White-eyed Pochard (*Nyroca rufa rufa*) ... 604
(B) Hodgson's Yellow-headed Wagtail (*Motacilla citreola citreoloides*) 604
Plate IV—(A) The Eastern Baillons Crake (*Porzana pusilla pusilla*) 605
(B) The Northern Ruddy Crake (*Amaurornis fuscus bakeri*) 605
Plate V—The Indian Little Grebe (*Podiceps ruficollis albipennis*)... 606
Plate VI—The Little Bittern (*Ixobrychus minutus minutus*) ... 607

The Identification of Indian Butterflies—

Plate I—*LYCÆNIDÆ*, *Amblypodia* 625

PAGE

Indian Dragonflies—

Plate I—Figs. 1-2. *Gomphus personatus* ♂♂ 659
Fig. 3. ,, *nilgiricus* ♂ 659
Fig. 4. ,, *o'doneli* ♂ 659
Fig. 5. *Heliogomphus ceylonicus* ♀ 659
Fig. 6. ,, *promelas* ♂ 659
Fig. 7. ,, *nietneri* ♂ 659

Birds of the Sikkim Himalayas—

Plate I—(A) Above Karponang 668
(B) Lachung Valley above Kedom 668
Plate II—(A) Lachung Valley. Looking North-east elevation, 9,000′ 674
(B) Lachung Valley, elevation, 8,800′ 674

A Record Sind Wild Goat—

Capra hircus blythi 699

No. 4

The Mammals and Birds of Kashmir and the adjacent Hill Provinces—

Shou (*Cervus wallichi*) 719

Birds of the Persian Gulf Islands—

Sketch-Map of Persian Gulf and Islands 725
Plate I—The Home of a Crab Plover Colony, Warba Island ... 728
Plate II—Cormorants nesting on Halul Islands 729
Plate III—(A) Cormorant (*Phalacrocorax nigrogularis*) Colony on Halul Islands 732
(B) Young Cormorants (*P. nigrogularis*) in white down on Farsi Island 732
Plate IV—(A) Young Ospreys in nest Halul Islands 733
(B) Site of Osprey's nest on Halul Islands 733
Plate I. Fresh-water Ciliates from Lahore 746
Plate II. ,, ,, ,, ... 750

The Identification of Indian Butterflies—

Plate XXIX—*LYCÆNIDÆ. Surendra, Loxura, Spindasis, Tajuria, Jacoona, Marmessus, Horaga, Catapeecilma, Hypolycæna and Artipe* 756
Indian Spikenard (*Nardostachys jatamansi*) 777
Kleothrips subramanii 787

Birds Nesting with a Camera in India—

Plate I—The Common Sandpiper (*Tringa hypoleuca*) 794
Plate II—(A) Hodgson's Pied Wagtail (*Motacilla alba hodgsoni*) ... 795
(B) The Common Sandpiper (*Tringa hypoleuca*) ... 795
Plate III—(A) The Common Sandpiper (*Tringa hypoleuca*) ... 798
(B) Jerdon's Little Ringed-Plover (*Charadrius dubius jerdoni*) 798
(C) Jerdon's Little Ringed-Plover (*Charadrius dubius jerdoni*) 798
Plate IV—(A) The Indian Pied Kingfisher (*Ceryle rudis leucomelanura*) 799
(B) Hodgson's Pied Wagtail (*Motacilla alba hodgsoni*) ... 799
(C) Kashmir Roller (*Coracias garrula semenowi*) ... 799

PAGE
Plate V—Jerdon's Little Ringed-Plover (*Charadrius dubius jerdoni*) 802
Indian Dragonflies 1—3 *Cyclogomphus* :—4–7 *Microgomphus* ... 854
Nests of the Common Indian Hornet (*Vespa cincta*) 858
Birds of the Sikkim Himalayas—
Plate XII—(A) Crags, North-west of Lachung Village ... 876
(B) Lachung Valley above the village 876
Plate XIII—(A) Sandakphu from Kalo Pokhari 886
(B) Kalo Pokhari Camp 10,160′ 886
Tiger-netting in Assam—
Plate I—No. 1. Men pulling on one of the 'Dhenki' Ropes ... 907
No. 2. A small portion of the spectators 907
No. 3. Tiger rushing across the enclosure 907
Crow's Nests and Electric Cables—
Plate :—No. 1. Crow's nest (weight 11 lbs.) made almost entirely of wire, built on the side strain insulator Brackets 913
Crow's nest of wire in process of construction on the over-head girder 913
A Butterfly swarm. (*Leucodice soracte*) 923
Synia melanaria, Muls., Predator on *Coptosoma ostensum*, Dist. ... 924

INDEX TO ILLUSTRATIONS

VOLUME XXX

Page

Acrocephalus agricolus, Pl. fig. 2 600
———*stentoreus brunnescens* Pl. fig. 1 600
Alcedo atthis pallasii, Pl. fig. 2... 601
Amaurornis fuscus bakeri, Pl. fig. 2 605
Amblypodia, sp. Pl. ... 625
Antilope cervicapra, fig. 2 ... 512
Artipe, sp. Pl. figs. ... 756
Butorides striatus javanica figs... 918
Capra hircus blythi, Pl. ... 699
Capreolus pygargus, fig. ... 721
Catapœcilma sp., Pl. fig. ... 756
Cervus wallichi, Pl. ... 719
Ceryle rudis leucomelanura, Pl. fig. 1 799
Chara brachypus, Pl. fig. 1 ... 590
———*brachypus*, Pl. v, fig. ... 599
———*braunii*, Pl. iii. ... 597
——————Pl. v, fig. ... 599
———*contraria*, Pl. v, fig. ... 599
———*corallina*, Pl. v, fig. ... 599
——— *fragilis*, Pl. v, fig. ... 599
———*gymnopitys*, v, fig. ... 599
———*hydropitys*, Pl. v, fig. ... 599
———*wallichii*, Pl. iv. ... 598
——————Pl. v, fig. ... 599
———*zeylanica*, Pl. v, fig. ... 599
Charadrius dubius jerdoni, Pl. figs. 1–2 795
—————— Pl. 802
Chilodon cucullus, Pl. fig. 11 ... 746
Coleps hirtus, Pl. fig. 4 ... 746
Colpidium colpoda, Pl. fig. 15 ... 750
——————*compyla*, Pl. fig. 14 ... 750

Page

Colpidium striatum, Pl. fig. 13 ... 750
Colpoda cucullus, Pl. fig. 16 ... 750
Coptosoma ostensum, Pl. figs. ... 924
Coracias garrula semenovi, Pl. fig. 3 799
Corvus splendens, Pl. ... 913
Cremastogaster auberti, Pl. figs. 1.23 541
Cyclidium glaucoma, Pl. fig. 19... 750
Cyclogomphus gynostylus, Pl. fig. 854
—————— figs. ... 856
——————*wilkinsi*, Pl. fig. 2. 854
—————— figs. 856
——————*ypsiton*, Pl. fig. 1. 854
—————— figs. 856
Didinium balbianii, Pl. fig. 6 ... 746
——— *nasutum*, Pl. fig. 5 ... 746
Dileptus gigas, Pl. fig. 7 ... 746
Diplosctichous, Pl. 1, fig. 3 ... 590
Felis tigris 655
Formicomus ninus, Pl. fig. 2 ... 541
Fulica atra atra, Pl. fig. 1 ... 601
Gastrostyla setifera, Pl. fig. 24 ... 750
Gazella bennetti, fig. 11 ... 522
——— *fuscifrons*, fig. 10 ... 521
——— *gutturosa altaica*, fig. 5. 517
——— (*Procapra*) *gutturosa*, Fig. 4 516
——— *seistanica*, fig. 9 ... 520
——— *subgutturosa sairensis*, Fig. 7 519
———*suqgutturosa subgutturosa*, Fig. 6 518
———*yarkandensis*, fig. 8 ... 519
Glaucoma scintillans, Pl. fig. 12. 750

Page

Gomphus nilghiricus, Pl. fig. 3 ... 659
——— *o'doneli*, Pl. fig. 4 ... 659
——— *personatus*, wings of ♂. 657
Pl. fig. 1, 2. ... 659
Halophrya simplex, Pl. fig. 1 ... 746
Halteria grandinella, Pl. fig. 21. 750
Heliogomphus ceylonicus, Pl. fig. 5 659
——— *nietneri*, Pl. fig. 7. 659
——— *promelas*, fig. ... 846
——— Pl. fig. 6. 659
Horaja, sp., Pl. figs. 756
Hydrophasianus chirurgus, Pl. fig. 3 601
Hypolycaena, sp., Pl. figs. ... 756
Ixobrychus minutus minutus, Pl. 607
Jacoona, sp., Pl. figs. 756
Kleothrips subramanii, Pl. ... 787
Labeo gonius, Pl. figs. 12, 13 ... 533
Lacrymaria striata, Pl. fig. 3 ... 746
Leeuwenia karnyi, fig. 791
Leucodice soracte, Plate ... 923
Loxophyllum meleagris, Pl. fig. 8 746
Loxura, sp., Pl. figs. ... 756
Lychnothamnus barbatus, Pl. v, fig. 599
Marmessus, sp., Pl. figs. ... 756
Microgomphus burmicus, Pl. fig. 6 ... 854
——— fig. 3 ... 856
——— *lilliputians*, Pl. fig. 7 854
———*souteri*, Pl. fig. 5. 854
——— fig. 1 ... 856
———*torquatus* fig. 2 ... 851
——— Pl. fig. 4 854
——— fig. 2 ... 856
Moschus moschiferus moschiferus, fig. 723
Motacilla alba hodgsoni, Pl. fig. 1 795
Pl. fig. 2 799
——— *citreola citreoloides*, Pl. fig. 2 604
Nardostachys jatamansi, Pl. ... 777
Nassula ambigua, Pl. fig. 10 ... 746

Page

Nassula rubens, Pl. fig. 9 ... 746
Natrix gilhodesi, Pl. fig. 2 ... 587
———*nigriventer*, Pl. fig. 1 .. 587
Nitella acuminata, Pl. ii, fig. 1 ... 596
——— Pl. v, fig. 2 ... 599
——— *batrachosperma*, Pl. v, fig. 10 599
———*hyalina*, Pl. v, fig. 16 ... 599
———*mirabilis*, Pl. ii, fig. 2 ... 596
Pl. v, fig. 1 ... 599
———*mucronata*, Pl. v, fig. 5 ... 599
Nyroca rufa rufa, Pl. fig. 1 ... 604
Ophiocephalus marulius, Pl. figs. 1-6, 14-19 532
Pandion haliaëtus, Pl. ... 733
Panthalops hodgsoni, Pl. ... 509
Phalacrocorax nigrogularis, Pls. 728, 732
Pleurotricha grandis, Pl. fig. 23... 750
Podiceps ruficollis albipennis, Pl. 606
Porzana pusilla pusilla, Pl. fig. 1. 605
Procapra przewalskii, fig. 3 ... 515
Saiga tartarica, fig. 1 ... 510
Sigmostomum indicum, Pl. fig. 20 750
Spathidium spathula, Pl. fig. 2 ... 746
Spindasis sp. Pl. figs. ... 756
Suastus gremius, fig. ... 570
Surendra sp., Pl. figs ... 756
Synia melanaria, Pl. figs. ... 924
Tajuria sp., Pl. figs. ... 756
Telotrochidium natthaii, Pl. fig. 18 750
Tolypella prolifera, Pl. v, fig. ... 599
Tringa hypoleuca, Pl. ... 794
——— Pl. fig. 2 ... 795
——— Pl. fig. 1 ... 798
Triplostichous, Pl. 1, fig. 2 ... 590
Upupa epops indica, fig. ... 916
Urocentrum turbo, Pl. fig. 17 ... 750
Urostyla weissii, Pl. fig. 22 ... 750
Vespa cincta, Pl. 858
Wallago attu, Pls. figs. 7-11 ... 533

ERRATA

Page ii, line 4 for *marilla* read *marila.*
,, 517 legend *for* fig. 4 *read* fig. 5.
,, 520 line 5 from bottom for *yarkandenisis* read *yarkandensis.*
,, 603 ,, 3 for *Tersephone* read *Terpsiphone.*
,, 604 legend for *Nycroca* read *Nyroca.*
,, 677 line 35 for *fusciphaga* read *fuciphaga.*
,, 682 ,, 21 for *xanthorhvnchus* read *xanthorhynchus.*
,, 688 ,, 11 from bottom for *Psitaacula* read *Psittacula.*
,, 688 ,, 32 for *Rostratulla* read *Rostratula.*
,, 703 ,, 2 for *marilla* read *marila.*
,, 703 ,, 3 ,, ,, ,, ,,
,, 726 ,, 33 for *Phaleropus* read *Phalaropus.*
,, 728 ,, 25 for *Hirunda* read *Hirundo.*
,, 729 ,, 35 for *Caladris* read *Calidris.*
,, 729 ,, 37 for *Phaleropus* read *Phalaropus.*
,, 787 plate illustrating *Kleothrips subramanii* should face page 789.
,, 798 line 4 from bottom for *garulla* read *garrula.*
,, 799 legend ,, ,, ,,
,, 893 line 6 from bottom for *ruficollies* read *ruficollis.*
,, 896 ,, 5 for *Accipier* read *Accipiter.*
,, 926 legend for *Epopa* read *Upupa.*

INDEX OF SPECIES

PAGE

Accipiter affinis 880
——— nisus melanoschistus ... 880
Aceros nipalensis 675
Acineta tuberosa 753
Acrocephalus agricolus 606
——— stentorlus brunnescens. 600
Ædon g. familiaris 727
Aeolothrips fulvicollis 864
Aeromachus indistincta 835
——— jhora 835
Aeshna ceylonica 849
——— promelas 848
Ægypius monachus 873
Æthopyga gouldiæ gouldiæ 666
——— ignicauda ignicauda ... 665
——— nipalensis nipalensis ... 666
——— saturata 666
——— siparaja seheriæ 665
Ailia coila 709
Alauda arvensis leiopus 664
——— gulgula guttata 664
Alcedo atthis bengalensis 674
——— ——— pallasii 600
——— iredalei 674
Aleurodothrips fasciapennis 869
Alophonerpes pulverulentus harterti... 671
Alsocomus pulchricollis 885
Amaurornis fuscus balicri 608
Ambassis nama 710
——— ranga 710
Amblopala avidiena 622
Amblyceps mangois 709
Amblypodia aberrans 637
——— ——— abseus abseus 637
——— ——— indicus 637
——— ——— mackwoodi ... 637
——— adala 635
——— adatha regia 629
——— adorea 629
——— adriana 638
——— xeta 635

PAGE

Amblypodia agaba agaba 630
——— ——— aurelia 630
——— agelastus 634
——— agesilaus 627
——— agnis 626
——— agrata 629
——— alaconia oberthuri ... 634
——— albopunctata 628
——— alea alea 630
——— ——— constancex 630
——— alemon 631
——— alesia 633
——— alitaeus mirabella .. 628
——— amantes amantes ... 632
——— ——— amatrix 632
——— ammonides ammonides... 636
——— ——— ariel ... 636
——— amphimuta 627
——— anarte 625
——— anniella artegal 638
——— anthelus anthea 625
——— ——— anthelus ... 625
——— antimuta 635
——— apha 629
——— apidanus ahamus ... 638
——— ——— apidanus ... 638
——— arata 629
——— areste areste 638
——— ——— arestina 638
——— ariana 628
——— arvina 635
——— asoka 638
——— asopia 634
——— atosia aricia 657
——— ——— atosia 627
——— atrax 628
——— bazaloides 633
——— bazalus 632
——— belphæbe 635
——— birmana 636
——— camdeo camdeo 626

PAGE
Amblypodia camdeo varro 626
—— canaraica 630
—— centaurus centaurus ... 631
—— —— coruscans ... 631
—— —— pirama ... 631
—— —— pirithous ... 631
—— chinensis 638
—— comica 634
—— cooperi 631
—— corinda acestes 633
—— diardi 637
—— dispar 626
—— dodonæa 634
—— duessa 635
—— ellisi 637
—— epimuta elsiei 627
—— eumolphus eumolphus... 632
—— —— nellenore ... 632
—— —— maxwelli ... 632
—— fulgida 637
—— fulla andamanica ... 639
—— —— ignara 639
—— ganesa ganesa 636
—— —— watsoni 636
—— hewitsoni... 630
—— horsfieldi eurysthenes ... 632
—— karennia 626
—— khamti 629
—— metamuta 627
—— moolaiana 627
—— ænea 629
—— opalina 626
—— pagaiensis 627
—— paraganesa paraganesa.. 636
—— —— zephyretta ... 636
—— paralea 631
—— paramuta 634
—— perimuta perimuta ... 635
—— —— regia 635
—— phœnops aroa 630
—— pryeri 630
—— rafflesii 628
—— rama rama 634
—— —— ramosa 634
—— silhetensis arama ... 629
—— silhetensis 628
—— singla 632
—— subfasciata 625
—— suffisa 626
—— vihara 633
—— woodii 633

PAGE
Amblypodia zeta 635
Amphileptus gigas 747
Ampittia dioscorides 832
Ampulex assimilis 735
Anaphothrips oligochætus 871
—— ramakrishnæ 871
Anas acuta acuta 893
—— penelope 893
—— platyrhyncha platyrhyncha ... 608
—— strepera 893
Andropogon schænanthus 780
Androthrips flavipes 869
—— ramachandrai 871
Anguilla bengalensis 709
Anisogomphus nietneri 847
Anser indicus 892
Anthracoceros coronatus affinis ... 675
Anthus campestris griseus 731
—— hodgsoni 701
—— triviates triviates 728
Antilope cervicapra 911
Apistus carinatus 641
Apodemus (nemomys) gurkha ... 530
Aporia leucodice soracte 923
Aptinothrips rufus, var. connaticornis 867
Aquila nipalensis nipalensis 875
Arachnothera magna magna 667
Araotes lapithis 775
Arborophila mandellii.... 890
—— rufogularis rufogularis ... 889
—— torqueola 889
Ardea insignis 892
Ardeola ralloides 733
Arenaria interpres 729
Arnetta vindhiana 574
Arrhenothrips ramakrishnæ 869
Artipe eryx 770
—— v. skinneri 770
Arvicola 530
Asio flammeus flammeus 684
—— —— leucopsis 684
Aspidisca costata 753
—— lynceus 753
Astur badius dussumieri 879
—— gentilis schedowi 879
——trivirgatus rufitinctus 880
Austrothrips cochinchinensis ... 868
Aviceda jerdoni jerdoni 881
Ayyaria chaetophora 871
Bactridothrips cerraticornis 870

PAGE

Bagarius yarrellii 709
Bandicota nemorivaga 528
Barbus crysopternus 708
——parrah 708
——sarana 708
——stigma 708
——stoliczkanus 708
Barilus bola 708
Batrachostomus hodgsoni 678
Belone cancila 710
Biduanda melisa cyara 766
————melisa 766
——nicevillei 767
——scudderii 767
——thesmia fabricii 767
————thesmia 767
Bindahara phocides areca 774
————moorei 774
————phocides 774
Biscunedens perfuscus 530
Blythipicus pyrrhotis pyrrhotis ... 671
Boiga cynodon 818
Boleophthalmus boddaerti 644
Bosephalus tragocamelus 523
Botia dario 708
——gelo 708
Brachytrypes achatinus 735
Bregmatothrips parviceps 867
————ramakrishnæ 867
Britomartis buto 761
——cleoboides 762
Bubulcus ibis coromandus 892
Bungarus fasciatus 819
——magnimaculatus 820
——multicinctus 819
Butastur teesa 877
Buteo ferox ferox 878
——hemilasius 878
——japonicus 878
Butis butis 644
——caperatus 643
Butorides striatus javanicus 918
Cacomantis merulinus passerinus ... 681
————querulus ... 681
Calandrella acutirostris tibetana ... 664
——brackydactyla dukhunensis. 664
Calidris alba 729
Callichrous bimaculatus 709
Calliophis macclellandi 820
Callophrys chalybeia 619

PAGE

Callophrys leechii 619
——rubi 619
Canis indicus 527
Capella nemoricola 891
——solitaria 892
——stenura 892
Capra hircus blythi 699
Capreolus pygargus 721
Caprimulgus indicus jotaka 678
————macrurus nipalensis ... 677
Carchesium epistylidis 753
——polypinum 753
Casarca ferruginea 893
Catla buchanani 708
Catopœcilma delicatum 768
————elegans major 768
——————myositina ... 768
————subochracea 768
Cecidothrips bursarum 868
Centropus bengalensis bengalensis ... 683
——sinensis sinensis 683
Cephalothrips hispanicus 868
Cerchneis tinnunculus saturatus ... 881
——————sub-sp. ? ... 881
Cervus albirostus 720
——wallichi 719
Ceryle lugubris guttulata 674
——rudis leucomelanura 799
Ceyx tridactylus tridactylus 674
Chaetoprocta odata 622
Chaimarrornis leucocephala 799
Chalcococcyx erythrorhynchus ... 682
————maculatus 682
Chalcoparia singalensis singalensis ... 668
Chalcophaps indica 884
Chara brachypus 597, 599
—— braunii 597, 599
——contraria 597
——corallina 597, 599
——fragilis 597, 599
——gymnopitys 597, 599
——hydropitys 597, 599
——wallichii 597, 599
——zeylanica 597, 599
Charadrius alexandrinus alexandrinus
726, 729
——curonicus dubius 729
——dubius curonicus 726
————jerdoni 795
——leschenaultii 729
——monjolus atrifrons 729

Page
Charana cepheis... 764
———mandarinus 764
———flavigula 528
Chela gora 708
Cheritra freja freja 766
—————jaffra 766
—————pseudojaffra 766
—————regia 766
Cheritrella truncipennis 765
Chetusia leucura 891
Chilaria kina cachara 769
—————kina 769
———merguia merguia 769
—————watsoni 769
Chliaria othona 769
Chilodon cucullus 748, 753, 755
Chlamydotis undulata macqueeni 726, 733
Chlidonias leucopareia indica... 605, 606
Choridactylus multibarbis 642
Chrysocolaptes gutticristatus gutticristatus... 671
Chrysopelea ornata 819
Chrysophlegma flavinucha flavinucha 669
Cinclus pallasii tenuirostris 800
Circus cyaneus cyaneus 878
——— macrourus 878
——— melanoleucus 878
——— pygargos 877
——— spilonotus 605
Cirrhina latia 708
——— mrigala ... 531, 537, 538, 708
——— reba 708
Clamator coromandus 682
——— jacobinus 682
Clarias magur 709
Clupea chapra 708
——— ilisha 708
Cocotropus echinatus 643
Cœnurothrips affinis 868
Coleps hirtus 753
——— kenti 753
——— uncinatus 753
Collacalia fuciphaga brevirostris ... 677
Colpidium colpoda 748, 753
——— comyla 748, 753
——— striatum 748, 753
——— truncatum 755
Colpoda cucullus 748, 753
Coluber leonardi 813
——— porphyraceus 812
——— prasinus 812

Page
Coluber radiatus 813
Columba leuconota gradaria 884
————— leuconota ... 884
——— rupestris turkestanica ... 884
Conophyma fedtschenkoi ... 559, 560
——— *ikonnikovi* sp. n. 559, 560
——— *jacobsoni* sp. n. ... 554, 560
——— *miramæ* sp. n. ... 553, 560
——— mitchelli ... 552, 560
——— *plotnikovi* sp. n. ... 556, 560
——— *pylnovi* sp. n. ... 558, 560
——— semenovi ... 551, 560
——— simile 556, 560
——— sokolowi 554, 560
——— uvarovi 560
——— weberi 560
——— *zubovskyi* sp. n. .. 551, 560
Coptosoma ostensum 924
Coracias benghalensis benghalensis... 673
——— garrulus semenowi ... 732, 798
Corvus corax ruficollis ... 725, 726, 727
——— coronoides intermedius ... 802
——— monedula soemmeringii 604, 798
——— splendens 913
Coryllis vernalis 684
Cothurnia sp. 753
Coturnix coturnix coturnix 889
Cremastogaster auberti sorokini ... 541
Creusa culta 762
Crocopus phoenicoptera phoenicoptera. 883
Cryptocheilus rubellus 735
Cryptothrips longus 869
Ctenogobius cyanomos... 646
——— griseus 648
——— *horai* sp. n. 645
——— masoni 648
——— *tuticorinensis* sp. n. ... 645
——— viridipunctatus 647
Cuculus canorus subtelephonus ... 728
———telephonus 678
———intermedius intermedius ... 679
———micropterus micropterus ... 679
———optatus 679, 802
Cuncuma leucorypha 877
Curetis acuta dentata 623
———bulis bulis 623
—————malayica 623
———phoedrus 623
———saronis gloriosa... 623
—————nicobarica 623
—————saronis 623

PAGE
Curetis sperthis ... 623
———thetis ... 623
Cursorius cursor... 729
————gallicus ... 729
Cyanops asiaticus asiaticus ... 673
———duvanceli cyanotis ... 673
———franklini franklini ... 673
Cyanosylvia suecica magna ... 732
Cyclidium glaucoma ... 750, 753
Cyclogomphus gymnostylus ... 856
————torquatus ... 852
————wilkinsi ... 856
————ypsilon ... 856
Cylindrophis rufus ... 806
Cynopterus sphinx ... 525
Cypselurus unicolor ... 640
Cyrtostomus asiaticus asiaticus ... 666
Dacalana penicilligera ... 760
——— vidura burmana ... 760
Demiegretta sacra asha 726, 730, 733
Dendrelaphis subocularis ... 813
Dendrophis pictus ... 813
Dendrothripoides ipomex ... 866
Dendrothrips bispinosus ... 865
————indicus... 865
————sexmaculatus ... 865
Dendrotreron hodgsoni ... 884
Deudoryx epijarbas amatius ... 770
————————v. diara... 770
—————ancus ... 770
—————epijarbas... 770
————hypargyria gaetulia ... 770
——————hypargyria ... 770
Diacaiothrips bruneitarsis ... 870
————crassiceps... 870
————dalla-torrensis ... 870
————greenei ... 870
————levis ... 870
————novus ... 870
————procer ... 870
————proximus... 870
Diaphorothrips unquipes ... 870
Diastatomma pars ... 657
Dicæum chrysorrhœum intensum ... 667
———ignipectum ... 667
———minullum olivaceum ... 667
Dichoceros bicornis ... 675
Dicrurus macrocercus albirictus ... 802
Didinium nasutum ... 746, 753, 755
————balbianii ... 746, 753
Dileptus gigas ... 747

PAGE
Dinothrips furcifer... 870
————sumatrensis... 870
Dinurothrips rutherfordi ... 867
Dipsadomorphus hexagonotus ... 818
—————multimaculatus ... 818
Dolichothrips ochripes... 871
————varipes ... 868
Doryichthys cuncalus ... 709
Dremomys lokriah lokriah ... 528
Drina donina ... 757
———maneia ... 757
Dryobates cathpharius cathpharius ... 670
———— darjellensis... 670
———— hyperythrus hyperythrus... 669
———— macei macei ... 670
Dormas ardeola... 733
Dryophis mycterizans ... 819
————prasinus ... 819
Ducula insignis insignis ... 883
Ecacanthrothrips sanguineus... 867
Echis cærinata ... 706
Elanus cæruleus vociferus ... 877
Eleotris fusca ... 710
Elephas maximus ... 912
Emberiza cineracea semenowi ... 728
———— hortulana ... 728, 733
———— melanocephala ... 728
Enchelys arcuata ... 753
Entomothera coromanda coromanda. 675
Eothrips florüperda ... 871
Eoxylides tharis ... 767
Epistylis articulata ... 753
Erethistes hara ... 709
Erionota acroleuca ... 586
——— thrax ... 585
Euaspa milionia... 619
Eugraulis tilara ... 708
Eumorphothrips albicornis ... 868
Euplotes charon ... 753
Eurystomus orientalis orientalis ... 673
Euthrips citrianictus ... 866
——— mavicinctus ... 867
Eutropüchthys vacha ... 709
Falco severus indicus ... 881
———subbuteo centralasiæ ... 881
———tinnunculus ... 733
——————tinnunculus ... 729
———vespertinus amurencis ... 888
Felis affinis ... 527
——pardus ... 909, 910
——tigris ... 652, 905, 907, 910

PAGE
Formicomus ninus 549
Frankliniella sulphurea 865
Frontonia leucas 753
Fuligula manta 703
Gavialis gangeticus 703
Galerida cristata 726, 728
Gallinago g. gallinago 608
Gallinula chloropus parvifrons ... 890
Gallus ferugineus murghi 887
Gangara thyrsis 582
Gastrostyla setifera 752, 753
Gazella bennetti 514, 522, 911
——fuscifrons 514, 521
——gutturosa altaica ... 514, 516, 517
—— gutturosa ... 514, 516
——siestanica 514, 520
——subgutturosa saviensis 514, 517, 518, 519
——subgutturosa 514, 517, 518
——typica 513
——yarkandensis 514, 519
Gecinulus grantia grantia 669
Gennæus leucomelanos melanotus ... 887
—— leucomelanus 917
Gigantothrips spinosus 870
—— tibialis 870
Glareola nordmanni 733
Glaucidium brodiei brodiei 873
—— cuculoides cuculoides ... 873
Glaucoma pyriformis 753
——scintillans 748, 753
Gomphus ceylonicus 849
——nietneri 847
——nilgiricus 660
——o'doneli 662
——personatus 657, 658
——promelas 848
——xanthenatus 658
Gunomys bengalensis 529
Gynaikothrips annuticornis 869
——fasciata 869
——interlocatus 871
——karnyi 869
——mirabilis 869
——plantaginis 869
——watsoni 869
Gypætus barbatus grandis 874
Gyps fulvus fulvescens... 873
—— himalayensis 873
—— indicus tenuirostris 874

PAGE
Hæmatopus ostralegus longipes ... 726
Haliastur indus indus 877
Halteria grandinella 751
Haplothrips ceylonica 868
——ganglbaueri 868
——pictipes 868
——ramakrishnæ 871
——soror 868
——sororcula 868
——tenuipennis 868
——terminalis 868
Heliogomphus ceylonicus ... 849, 850
——nietneri 847, 850
——promelas ...846, 848, 850
——pruinans 848
——*selysi* sp. n. 850
——*walli* sp. n. ... 849, 851
Heliophorus androcles androcles ... 618
—— coruscans ... 618
—— brahma 618
—— moorei birmana 618
—— sena 618
—— tamu 618
—— viridipunctata kala ... 618
—— ——viridipunctata 618
Heliothrips brunneipennis 865
—— hæmorrhoidalis 865
—— indicus 865
—— minutissimus 865
Heodes casyapa evansii 617
—— susanus 617
—— kasyapa 617
—— v. zariaspa 617
—— pavana 616
—— phlæas flavens 617
—— indicus 616
—— stygianus 616
—— phœnicurus 617
—— solskyi aditya 617
—— tseng mandersi 617
Herpestes auropunctatus 527
——nipalensis 527
—— urva 527
Heliophous epicles indicus 618
—— kohimensis ... 618
Hieraetus fasciatus fasciatus 875
Hierococcyx fugax nisicolor 681
—— sparverioides 680
—— varius 681
Hindsiana apicalis 868

PAGE
Hippolais languida 727
Hipposideros armiger 526
Hirudapus caudacuta nudipes ... 677
Hirundo daurica nepalensis 601
——— rufula 731
——— rustica 728
——— ——— gutturalis 601
Helophrya annandalei 752
———— bengalensis 752
———— indica 752
———— lateralis 752
———— simplex 745, 752
Homalopsis buccata 817
Hoplopterus ventralis 891
Horaga albimacula 768
——— halba 768
——— onyx cingalensis 768
——————— onyx 768
——————— rana 768
——— viola 768
Horsfieldia anita andamanica ... 624
———————— anita 624
———————— v. darana 624
———————— naradoides 624
———— narada taooana 624
Huhua nipalensis 872
Hurria rhynchops 817
Hydatothrips ramaswamiah 871
Hydrophasianus chirurgus 605
Hypolycæna erylus andamana ... 769
———— ——— himavantus ... 769
———— nilgirica 769
———— thecloides nicobarica ... 769
——————— thecloides ... 769
Hypsirhina enhydris 817
———— plumbea 817
Ibidorhyncha struthersi 891
Ictinaetus malayensis perniger ... 875
Idacapus sylvatica 677
Idolothrips halidayi 870
———— schentilingi 870
Indicator xanthonotus 672
Irania gutturalis... 728
Iraota rochana boswelliana 624
Iraota timoleon nicevillei 624
————— timoleon 624
Ischyrothrips crassus 869
———— niger 869
———— obscurus 869
Ithagenes cruentus cruentus 888
Ixobrychus minutus minutus 601

PAGE
Iyngipicus semicoronatus 671
Iynx torquilla japonica 672
Jacoona anasuja 765
Jamides bochus bochus 613
———— ——— nicobaricus 613
——— cærulea... 615
——— celeno bairana 614
———— ——— celeno 614
———— ——— kinkurka 614
———— ——— nicevillei 614
———— ——— tissama 614
——— cleodus pura 614
——— coruscans 613
——— elpis eurysaces 614
——— ——— kondulana 615
——— ——— meilichius 614
——— jesous gamra... 615
——— kandena kandena 615
———— ——— pseudelpis 615
——— lacteata 614
——— lugine purpura 615
——— philatus subdita 614
——— ubaldus 615
——— uranus 615
——— urios 615
Ketupa ceylonensis nigripes 872
——— flavipes 872
——— zeylonensis 914
Kleothrips subramanii sp. n. 788
Labeo gonius 531, 537, 538, 708
——— rohita 708
Lacrymaria striata sp. n. ... 746, 753
———— vermicularis 753
Lanuis excubitor 726
——— e. aucheri 727
——— isabellinus 727
——— nubicus 727
——— phoenicuroides 727
——— schach erythronotus ... 603, 798
——— senator niloticus 727
——— vittatus 727
Larus fuscus taimyrensis 731
——— gelastes 726
——— genei 726, 731
——— hemprichi 729, 731
——— ridibundus 726, 731
Leeuwenia coriaceus 870
———— engeniae 870
———— indicus 870
———— *karuyi* sp. n. 789
Lepidocephalichthys gantea 708

Page
Leptogomphus nietneri ... 847, 850
Lepus ruficaudatus 530
Lerwa lerwa 890
Liopeltis dorix 816
——— frenatus 816
Liothrips niger 867
——— ordinarius 867
——— sp. 867
Liphyra braseolis 775
Listeria dudgeoni 619
Lobivanellus indicus aigneri 726
Lophastur leuphotes leuphotes ... 881
Lophophorus impejanus 887
Lophotriorchis kieneri 875
Loxodes rostrum 753
Loxophyllum fasciola 753
——— puryabensis ... 753
——— meleagris ... 747, 753
Loxura atymnus arcuata 757
——— atymnus 757
——— prabha 757
——— surya 757
Lycæna fusca cymbia 616
——— fusca 616
——— tessellata 616
Lycænesthes emolus andamanicus ... 615
——— emolus ... 615
——— lycænina lycambes ... 616
——— lycænina ... 616
Lychnothamnus barbatus ... 597, 599
Lycodon aulicus 811
——— fasciatus 812
Lyncornis cerviniceps cerviniceps ... 678
Macaca mulatta 525
Macrocarpus integrifolia 865
Macrones aor 709
——— cavasius 709
——— tengara 709
Macropygia tusalia tusalia 886
Mahathala ameria 624
——— atkinsoni 625
Maneca bhotea 761
Manto hypolenea martina 765
Mantoides licinius 765
Mareca penelope 608
Marmessus lisias boisduvali 767
Mastacembelus armatus ... 710, 711
——— pancalus 711
Matapa aria 577
Megalæma virens marshallorum ... 672
Melanocorypha maxima 664

Page
Melittophagus erythrocephalus erythrocephalus 674
Mergus merganser orientalis 893
Merops apiaster 728
——— orientalis orientalis ... 604, 674
——— persicus persicus 728
Mesodinium pulex 753
Mesothrips angusticornis 869
——— apatelus 871
——— brevis 869
——— indicus 869
——— karnyi 869
——— melinocnemis 871
Microgomphus burmicus sp. n. 854, 856
——— chelifer 856
——— *lilliputians*, sp. n. ... 855
——— souteri ... 853, 856
——— torquatus ... 851, 852, 856
——— verticalis 857
Microhierax cærulescens cærulescens. 882
Micropternus brachyurus phaioceps ... 671
Micropus affinis affinis 676
——— melba melba 676
Micropus murinus 725
——— murinus 728
Microscelis psaroides psaroides ... 842
Microtus sikimensis 530
Milvus lineatus 877
——— migrans ... 726, 729, 732
——— govinda 877
Minous monodactylus 642
Mollotus phillippinensis 784
Monacanthus setifer 650
Monticola saxatilis ... 728, 732, 733
Moschus myschiferus 530
——— moschiferus ... 723
——— sifanicus ... 724
Mota massyla 756
Motacilla alba dukhunensis ... 728, 731
——— hodgsoni ... 604, 795
——— cinerea 728
——— melanope 799
——— citreola citreoloides ... 606
——— feldegg melanogriseus ... 728
——— flava beema ...728, 731, 732
Mugil corsula 710
Muntiacus crinifrons 722
——— vaginalis 530, 722
Mus brunneusculus 529
—— dubius 529
—— homourus 529

PAGE
Mus manei ... 529
—— rattus ... 529
—— urbanus ... 529
Muscadivora æna sylvatica ... 883
Muscicapa hypolema semitorquata ... 727
Mustela subhemachalana ... 528
Mycterothrips setiprivus ... 871
Myiophoneus horsfieldi temmincki ... 800
Myotis formosus ... 905
——— sicarius ... 526
Nacaduba akaba gythion ... 612
——— aluta cœlestis ... 612
——— ancyra ... 611
——— angusta kerriana ... 610
——— atrata euplea ... 612
————— promineus ... 612
——— berenice nicobaricus ... 612
——— bhutea ... 612
——— dana ... 613
——— dubiosa ardates ... 613
————— fulva ... 613
————— indica ... 613
————— nora ... 613
————— sivoka ... 613
——— hermus nabo ... 610
——— nora ... 612
——— noreia hampsoni ... 613
————— noreia ... 613
——— pactolus andamanicus ... 610
————— ceylonicus ... 610
————— continentalis ... 610
————— macropthalma ... 610
——— pavana ... 611
——— sinhala ... 612
——— vajuva ... 611
——— viola merguiana ... 611
————— sidoma ... 611
————— viola ... 611
Naia hanna ... 706
—— hannah ... 820
—— naia ... 820
Nandus marmoratus ... 710
Nangra viridescens ... 709
Nardostachys jatamansi ... 777
Nassula, sp. ... 753
——— ambigua ... 748, 753
——— rubens ... 747, 753
——— stromphii ... 753
Natrix bitæniata, sp. n. ... 806
——— *clerki*, sp. n. ... 809
——— *gilhodesi*, sp. n. ... 587, 808

PAGE
Natrix khasiensis ... 808
——— leonardi ... 808
——— *nigriventer*, sp. n. ... 588
——— nuchalis ... 808
——— venningi ... 921
Nemachilus botius ... 708
————— tibetanus ... 923
Nemomys gurkha ... 530
Nemorhædus hodgsoni ... 530
Neocheritra amrita ... 765
————— fabronia ... 765
Neodon sikimensis ... 530
Neoheegeria citripes ... 868
—————indica ... 868
—————fumipennis ... 868
—————zizyphi ... 868
Neolycæna sinensis ... 618
Neomyrina hiemalis ... 766
Neophron percnopterus ... 726
Nerodia modesta ... 809
———piscator ... 809
Ninox scutulata lugubris ... 873
Nitella acuminata ... 597, 598
———batrachosperma ... 597, 598
———hyalina ... 597
———mirabilis ... 597, 598
———mucronata ... 597, 598
Notopterus chitala ... 708
————kapirat ... 708
Numenius arquatus lineatus ... 726
Nuria daurica ... 708
Nycticebus coucang ... 904
Nycticorax n. nycticorax ... 605
Nyctiornis athertoni ... 674
Nyroca rufa rufa ... 608
Ochotona roylei nepalensis ... 530
Odontogobius bynœnsis ... 649
Œdicnemus œdicnemus astutus ... 729
Œnanthe deserti atrogularis ... 727
————isabellina ... 727
————leucomela leucomela 727, 731
————œnanthe ... 731
————picata ... 727
Oligodon albocinctus ... 815
————calamaria ... 816
————cyclurus ... 814
————hamptoni ... 814
————herberti ... 813
————major ... 816
————purpurascens ... 815
————rappi ... 816
————splendidus ... 816

PAGE
Oligodon theobaldi 815
———torquatus 814
———tricolor 816
———violaceus 814
Ophichthys boro 709
Ophiocephalus gachua ... 534, 710
———marulius 531
———punctatus ... 534, 710
———raj 534
———striatus 534, 535, 710
Ophryoglena sp. 753
Oriolus oriolus kundoo 804
Otocorys alpestris elwesi 664
Otostoma carteri 753
Otus bakkamœna lettia 873
———scops pennatus 872
———pulchellus 728, 732
———spilocephalus 872
Ovis vignei punjabensis 838
Oxytricha fallax 755
Oxyurichthys tentacularis 650
Pachyglossa melanoxantha 667
Pachyura sp. 526
———perrotteti 527
Paguma grayi 527
Palumbus palumbus casiotus ... 884
Panchœtothrips indicus 867
Pandion haliaetus 726, 728, 731
———haliætus 873
Pantholops hodgsoni 511
Parachœturichthys polynema ... 649
Paramœcium aurelia 753, 755
———bursaria 753
———caudatum ... 753, 755
Parexocœtus mento 640
Parus major kashmiriensis 606
Patrinia jatamansi 782
Penthoceryx sonneratii sonneratii ... 681
Perissospiza affinis 700
Perissothrips parviceps 867
Pernis cristatus ruficollis 880
Petaurista caniceps 528
———magnificus 528
———nobilis 528
Phæthon ætherius indicus ... 725, 729, 731
Phalacrocorax carbo 726
———fuscicollis 892
———nigrigularis ... 731, 732
Phalaropus lobatus 726, 729
Phlœothrips anacardii 867
——— stenomelas 867

PAGE
Phœnicurus ochruros phœnicuroides.. 728
——— phœnicurus mesoleucus. 728
——— phœnicurus 732
Photodilus badius 684
Phoxothrips breviceps 870
——— ceylonicus 870
——— gigans 870
Phylloscopus c. collybita 727
——— c. tristis 727
Physothrips andrewesi 866
——— brunneicornis 866
——— flavidulus 866
——— lefroyi 865
——— longiceps 866
——— minor 866
——— peculiaris 866
——— usitatus 865
——— vitata 866
Pica pica bottannensis 914
Picumnus innominatus innominatus.. 672
Picus canus gyldenstolpei 669
——— chlorolophus chlorolophus ... 669
Pipistrellus babu 526
Piprisoma squalidum squalidum ... 667
Pithecus schistaceus 525
Pitta brachyura 668
——— cucullata cucullata 668
——— nipalensis nipalensis 668
Pitymys 530
Plagiopholis blackewayi 810
Planesticus unicolor 604
Plastingia submaculata 563
Pleurotricha grandis 752, 753
Plurlatis dominicus fulvus 891
Podiceps ruficollis albipennis ... 602
——— capensis 893
Podisina almasyi 560
Podophrya fixa 753
——— libera 753
Polyodontophis collaris 806
Polyrhachis 546
Porphyrio poliocephalus poliocephalus 890
Portax pictus 523
Porzana bicolar 890
——— fusca bakeri 890
——— pusilla pusilla 608
Pratapa cleobis 761
——— cotys 760
——— ctesia 760
——— deva deva 761

PAGE
Pratapa deva lila 761
——— icetas extensa 761
————— icetas 761
————— mishmia 761
——— icetoides carmentalis ... 761
————— icetoides 761
——— lucida argentea 760
————— minturna 760
Procapra gutturosa 514, 516
——— picticaudata 514
——— przewalskii 514, 515, 517
Prorodon eudentatus 753
——— teres 753
Psammochares metas 735
————— rutilus 735
Psammadynastes pulverulentus ... 818
Psarisomus dahousix 669
Pseudeutropius garua 709
Pseudodendrothrips ornatissima ... 865
Pseudogyps bengalensis 874
Pseudeutropius murius 709
Psittacula alexandri fasciata 683
——— eupatria indoburmanica ... 683
——— schisticeps schisticeps ... 683
Pterocles indicus 917
——— senegallus 729
Pterois russellii 921
——— volitans 921
Pteromys caniceps 528
——— magnificus 528
Ptyas mucosus 812
—— nigromarginatus 812
Puffinus persicus 730
Purlisa gigantea 765
Pycnonotus leucotis 726
Pyrotrogon erythrocephalus erythrocephalus 678
Python molurus 806
Pyxicola carteri 753
Ramaswamiahella subnudula ... 871
Ramakrishnaiella unispina 871
Ramphalcyon capensis gurial ... 674
Rapala abnormis 771
——— buxaria 773
——— dieneces dieneces 773
————— intermedia 773
——— hades 772
——— jarbas 773
——— kessuma deliochus 771
———lankana 771
———melampus 773

PAGE
Rapala micans selira 773
———nissa nissa 773
—————nissoides 772
—————rectivitta 773
—————v. rosacea ... 773
——— pheretimus pheretimus ... 773
————— petosiris 773
———refulgens 771
———schistacea 772
———scintilla 772
———sphinx rhoecus 772
—————sphinx 772
———subguttata... 771
———suffusa rubicunda 771
————— suffusa 771
———tara 772
———varuna grisea 772
————— lazulina... 772
————— orseis 772
————— rogersi 772
Rasbora daniconius 708
Rathinda amor 767
Rattus eha 529
——— fulvescens 529
——— niveiventer 529
——— rattus brunneusculus 529
—————rattoides 529
Rhabdophis speciosus, sp. n.... ... 734
—————stolatus 810
————— subminiatus 810
Rhabdops bicolor 810
Rhamphothrips lineata 866
Rhinolophus a. himalayanus... ... 526
—————luctus perniger 526
—————rouxi 526
Rhipiphorothrips bicolor 865
————— cruentatus 865
Rhopodytes tristis 683
Rhynchobdella aculeata 710, 711
————— dhanashorii 711
Rhyacornis fuliginosa 799
Rhynehothrips pallipes... 871
Riparia riparia 731
Rita buchanani 709
Rohtee cotio 708
Rostratula benghalensis benghalensis 608
Rousettus leschenaulti 525
Saccobranchus fossilis 709
Saiga tartarica 510
Sarcogrammus indicus indicus ... 890
Sasia ochracea ochracea 672

PAGE
Saxicola torquata maura 728
Schizopygopsis younghusbandi ... 923
Sciœna coitor 710
Scirtothrips dorsalis 865
———— signipennis... 865
Sciuropterus caniceps 528
———— chrysothrix 528
———— magnificus 528
———— nobilis 528
———— senex 528
Scolopax rusticola 919
———— rusticola 891
Scyphidia formentelii 753
Selenothrips mendax 865
———— rubrocinctus 865
Semanga superba 757
Scrilophus lunatus rubropygius ... 668
Sigmostomum indicum sp. n... ... 751
Silundia gangetica 709
Sinthus nasaka amba 774
———— pallidior 774
Sinthusa chandrana chandrana ... 774
———— grotei 774
———— v. albidus ... 774
———— v rubidus ... 774
———— virgo 774
———— v. contusa 774
Sisor rhabdophorus 709
Sithon nedymond ismarus 775
Slylothrips brevipalpis... 871
Soriculus caudatus 526
———— nigrescens centralis ... 526
Spathidium spathula moniliforme ... 745
————var. moniliforme bhatia ... 753
Sphærophrya sp. 753
———— pusilla 753
Sphenocercus apicauda 883
———— sphenura sphenura ... 883
Sphex lobatus 735
Spilornis cheela cheela 876
Spindasis abnormis 758
———— acamas chitralensis... ... 758
———— hypargyros... ... 758
————elima elima 759
———— fairliei 759
———— uniformis 759
———— elwesi 759
———— epargyros 757
———— ictis ceylanica 759
———— ictis 759

PAGE
Spindasis lohita himalayanus ... 760
———— lazularia ... 760
———— seliga 760
———— zoilus 760
———— lilacinus 758
———— maximus 759
———— nipalicus evansii 759
———— nipalicus ... 759
———— sani 759
———— nubilus 758
———— rukmini 759
———— schistacea gabriel 758
———— schistacea ... 758
———— syama peguanus 759
———— vulcanus fusca 758
———— tavoyana 758
———— vulcanus 758
Spizaetus cirrhatus 914
———— ceylonensis ... 915
———— nipalensis nipalensis ... 876
Squatarola s. squatarola 729
Stentor cæruleus 755
Streptopelia chinensis suratensis ... 886
———— orientalis agricola ... 886
———— meena ... 885
———— orientalis ... 885
———— turtur arenicolor ... 733
Sterna albigena 731
———— anæthetus fuligula ...726, 729, 730, 731, 733
———— bengalensis bengalensis ... 726, 731, 733
———— bergii velox 726, 713
———— repressa 726, 729, 730, 731, 733
———— s. sandwichensis 726
Stigmostomum indicum g.n. sp. n. ... 753
Strix aluco nivicola 684
———— indrani newaxensis 684
Strymon mackwoodi 619
———— sassanides 619
Suasa lisides 765
Suastus bipunctus 573
———— gremius 568
Surendra amisena 756
———— florimel 756
———— quercetorum biplagiata ... 756
———— discalis ... 756
———— quercetorum. 756
———— todara distorta 756
———— karennia 756
————todara 756

PAGE
Surniculus lugubris dicruroides ... 682
Sylvia curruca affinis 707
——— h. crassirostris 727
——— mystacea 727
——— n. nana 727
Synia melanaria 924
Syrrhaptes tibetanus 887
Taccocua leschenaultii infuscata ... 683
Taeniothrips major 865
Tajuria albiplaga 763
——— cippus cippus 764
—————— longinus 764
——— diaeus 763
——— donatana 762
——— illurgroides 764
——— illurgis 764
——— isaeus 763
——— ister 763
——— jalindra indra 764
——————— macarita 764
——————— tarpina 764
——— jangala andamanica 762
——————— ravata 762
——— jehana 764
—————— var. ceylanica 764
——— luculentus nila 764
——— maculata 764
——— mantra 763
——— megistia megistia 762
——————— thria 762
——— mela stigma 763
—————— oeeta 763
——— ogyges 763
——— sebonga 763
——— thyia 763
——— yajna ellisi 762
—————— istroidea 762
—————— yajna 762
Taractrocera ceramas 824
—————— mævius 829
Telotrochidium matthaii sp. n. 753, 754
——————— *natthaii* sp. n. ... 749
Terias blanda 714
——— rotundalis 714
——— sari 714
——— silhetana 714
——— templetoni 714
——— uniformis 714
Terpsiphone paradisi paradisi ... 603
Tetraogallus tibetanus tibetanus ... 890
Tetrodon cutcutia 711

PAGE
Thaduka multicaudata kanara ... 624
————multicaudata 624
Thamala miniata 767
Thecla ataxus ataxus 620
——————zulla 620
——— bieti dohertyi 620
—————vima 620
—————mandara 620
———birupa 621
———doni 621
——— duma duma 621
—————— dumoides 621
—————————— *v.* intermedia. 621
———icana 619
———jakamensis 621
———kabrua 621
———khasia 622
———kibariensis 622
———letha 621
———paona 622
———pavo 620
———suroia 620
———syla assamica 622
—————syla 622
———vittata 621
———ziha 622
———zoa 621
Thereiceryx lineatus hodgsoni ... 673
Thrips colorata 866
———florum 866
———longalata 866
———magnipes 866
———nigriflava 866
———oryzæ 866
———parva 866
———pallida 866
———pallidulus 866
———striatopennata 866
———sulphurea 896
Ticherra acte 766
Tiga shorei 671
Tokophrya quadripartita 753
Tolypella prolifera 597, 599
Tomeutes lokroides 528
Torgos calvus 873
Tragopan satyra 888
Treron curvirostra nipalensis ... 883
Trichoda pura 753
Trichogaster lalius 710
Trichothrips fructuum 868
Trichothrips hadrocerus 871

PAGE
Trimeresurus gramineus 821
——————monticola 821
Tringa hypoleucus ... 726, 798
———ochropus 891
Trirhinopholis nuchalis 811
Tryphactothrips mundus 871
———————octarticulata ... 867
———————rutherfordi 867
Turdoides somervillei 687
Turdus unicolor 804
Turnix dussumieri 890
———pugnax ocellatus 890
———tanki tanki 890
Typhlops diardi 805
Upupa epops epops 728, 731
——————indica 916
——————orientalis ...604, 676, 802
——————saturatus 676
Urocentrum turbo 749, 753
Uroleptus mobilis 755
Uroloncha malabarica 728
Urostyla weissii 752, 753
Urotricha globosa 753
Vaginicola sp. 753
Valeriana jatamansi 782

PAGE
Valeriana officinalis 784
—————wallichii 782
Vespa cincta 858
———orientalis 859
Vibris anser 747
Vipera lebetina 707
———russelli 821
Virachola isocrates isocrates 770
——————————rosacea 770
—————perse ghela 770
———————perse 771
Viverra zibetha 527
Vorticella campanula 753
—————citrina 753
—————convallaria 753
—————microstoma 753
—————pattellina 753
Wallago attu 531, 538, 709
Xenopeltis unicolor 806
Yasoda tripunctata 757
Zamenis korros 812
Zeltus etolus 769
Zesius chrysomallus 760
Zographetus ogygia 575
Zosterops palpebrosa elwesi 665

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CONTENTS OF Vol. XXX, No. 3.

PAGE.

THE MAMMALS AND BIRDS OF KASHMIR AND THE ADJACENT HILL PROVINCES. Part IV. By Col. A. E. Ward. (*With a plate and text-figures.*) 509

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMA AND CEYLON. Report No. 37 (*a*) Nepal. By T. B. Fry 525

EARLY STAGES IN THE DEVELOPMENT OF SOME FRESH WATER FISHES IN THE PUNJAB. By M. Hamid Khan, M. SC., F.R.M.S. (*With 3 plates*) 531

THE CREMASTOGASTER ANT. By Major R. W. G. Hingston, I.M.S. (*With a plate*) ... 541

SOME NEW ALPINE GRASSHOPPERS OF THE GENUS *Conophyma*, ZUB., FROM CENTRAL ASIA. By B. P. Uvarov, F.E.S 551

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA. Part XXXIV. By T. R. Bell, C.I.E., I.F.S. (Retd.) (*With a text figure*) 561

TWO NEW BURMESE SNAKES. (*With a plate.*) By Col. F. Wall, I.M.S., etc. 587

NOTES ON CHAROPHYTES FROM GONDA, U.P. (*With 5 plates.*) By G. O. Allen, I.C.S. . 589

BIRDS' NESTING WITH A CAMERA IN INDIA. Part IV. (*With 6 plates.*) By Capt. R. S. P. Bates 600

THE IDENTIFICATION OF INDIAN BUTTERFLIES. Part VII. (*With plates.*) By Col. W. H. Evans, D.S.O., F.Z.S., F.E.S. 610

NOTES AND DESCRIPTION OF INDIAN FISHES. Part III. By H. W. Fowler. 640

AN ENCOUNTER WITH A FIGHTING TIGER. (*With a photo.*) By Col. R. W. Burton, I.A. (Retd.) 652

INDIAN DRAGONFLIES. Part XXI. (*With a plate & a text-figure.*) By Major F. C. Fraser, I.M.S., F.E.S. 657

NOTES ON THE BIRDS OF THE SIKKIM HIMALAYAS. Part VI. (*With a plate.*) By Herbert Stevens, M.B.O.U. 664

REVIEWS.—IN THE HIGHER HIMALAYAS. By H. Whistler, F.Z.S. 686

A GENERAL TEXT BOOK OF ENTOMOLOGY. By A. D. Imms 687

EDITORIAL 689

MISCELLANEOUS NOTES :—

I. Breeding season of the Nilgiri Langur. By Rev. C. Leigh, S.J. 691

II. Wild Dogs and Jungle Tragedies. By R. C. Morris 691

III. "Wild Animals of Central India." By R. C. Morris (with a note by A. A. Dunbar Brander) 694

IV. A Black Jackal. By M. S. Tuggerse 698

V. The Record Sind Wild Goat (*Capra hircus blythi*). (*With a plate.*) By R. L. McCulloch 699

VI. The Allied Grosbeak (*Perrisospiza affinis*, Blyth). By H. Whistler, F.Z.S... 701

CONTENTS OF Vol. XXX, No. 3.

PAGE

VII. On the breeding of the Indian Tree Pipit (*Anthus hodgsoni*) in Kulu. By H. Whistler, F.L.S., F.Z.S. 701

VIII. The Cotton Teal. By Sir Harcourt Butler 702

IX. Occurrence of the Scaup Duck (*Fuligula marilla*) in Northern India. By S. H. Prater, C.M.Z.S. 703

X. The length attained by and the habits of the Gharial (*G. gangeticus*). By Major C. R. S. Pitman 703

XI. Boa Constrictor *vs.* Alligator. (*With a photo.*) By Editors 704

XII. Tiger killed by a Cobra. (*With a photo.*) By Editors 705

XIII. Record of a death from bite of the Hamadryad or King Cobra (*Naia hanna*). By C. Theobald, F.Z.S. 706

XIV. Recovery from the bite of *Echis carinata*. By Capt. H. J. Rice, I.M.S. ... 706

XV Viper and White-Throat. By B. B. Osmaston, I.F.S. (Retd.) 707

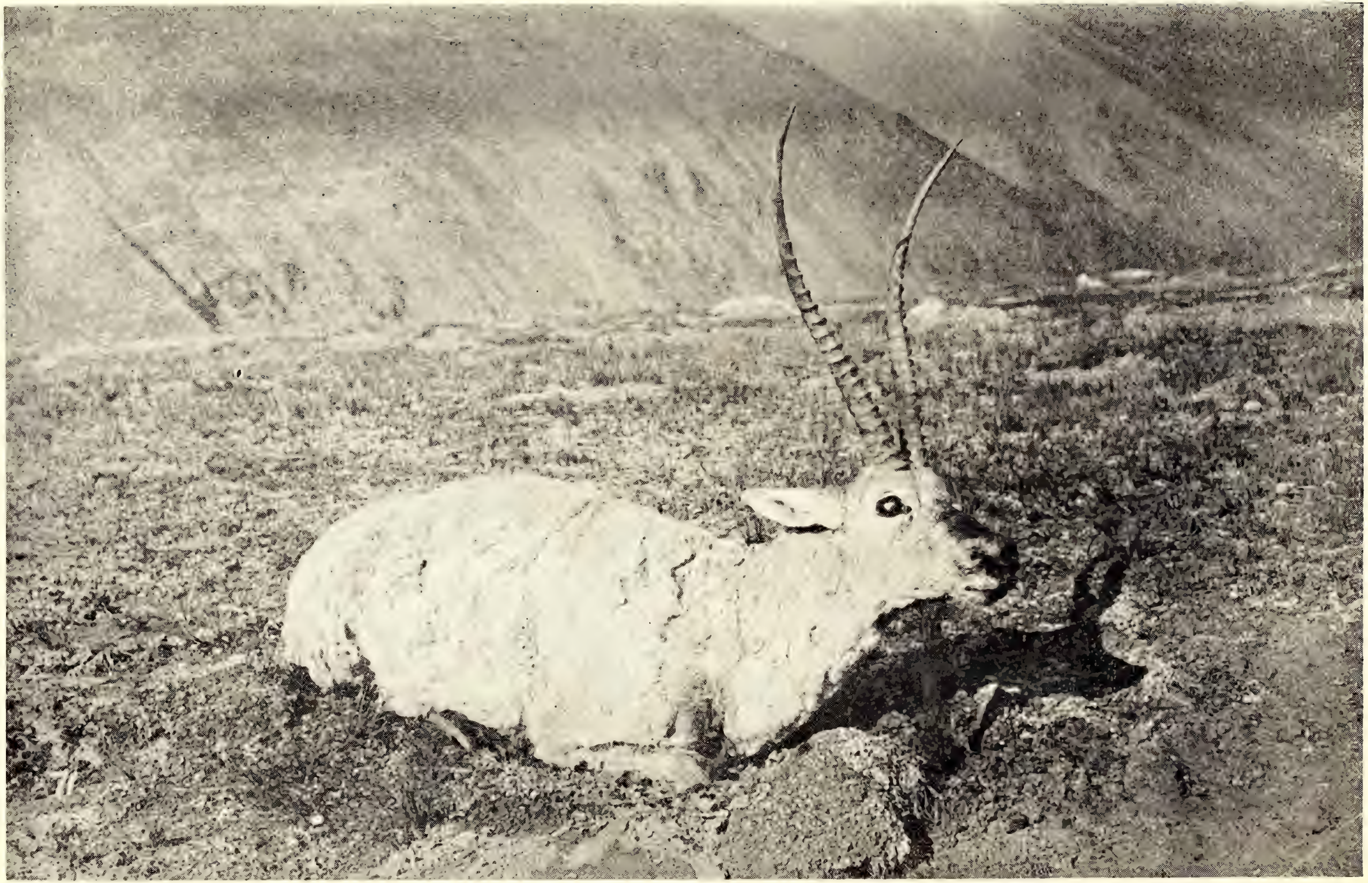
XVI. A List of Fishes obtained in the Saran District, Bihar, chiefly from the Ghogra River, near the town of Chapra and in its vicinity. By E. A. D'Abreu, F.Z.S. 707

XVII. The Occurrence of the Spiny-Eel. By E. A. D'Abreu, F.Z.S. 711

XVIII. Formula for estimating weight of Mahseer. By Major W. B. Trevenen. .. 711

XIX. The Ceylon Races of *Terias blanda*, Bdv., and *Sari*, Horsf. By H. T. G. Watkins 714

PROCEEDINGS 715



Tibetan Antelope (*Panthalops hodgsoni*).

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THE MAMMALS AND BIRDS OF KASHMIR AND THE ADJACENT HILL PROVINCES.

BEING NATURAL HISTORY NOTES.

BY

COL. A. E. WARD.

PART IV.

(*Continued from page* 131 *of this Volume.*)

(*With* 1 *plate and* 11 *text figures.*)

Family—BOVIDÆ.

The present article deals with some members of this family which were excluded from my previous article on the Bovidæ. The various Indian Central Asian Antelopes, Gazelles, the Saigas and the Nilgai are grouped in the following 4 sub-families:—

I. *Saiginæ* (The Saigas).

II. *Panthalopinæ* (The Tibetan Antelope).

III. *Antelopinæ* (Antelopes and Gazelles).

IV. *Tragelaphinæ* (Nilgai).

I. Sub-family—*SAIGINÆ.*

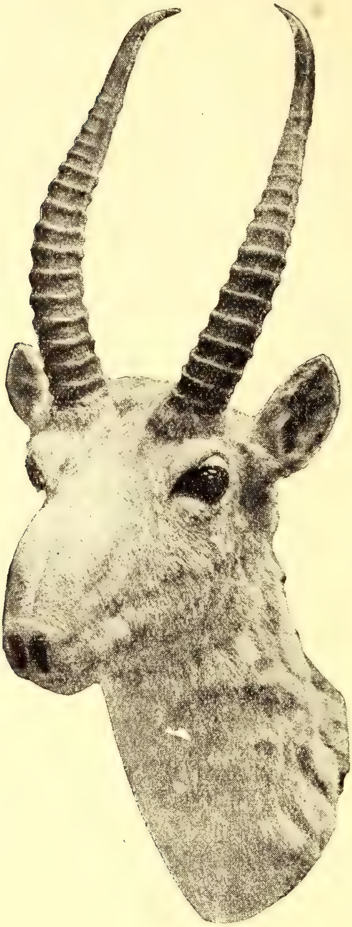


FIG. 1.—Saiga Antelope (*Saiga tartarica*).

THE SAIGA ANTELOPE—*Saiga tartarica.*

The late Mr. P. W. Church mentions having seen a pair of horns at Urumtsi and heard of these Antelopes to the North (Urumtsi is between 400 and 500 miles west of Kuldja); he mentions that as the horns are considered to have medicinal properties they may have come from other parts. However he was not very far from the habitat of the Saiga. It lives in Siberia and Western Turkistan, to the westward and northwestward of Kuldja and in Southern Russia. Reports of this animal were received from my collectors high up in a branch of the Volga near the Ural mountains and this tallies with the habitat assigned to it.

I am greatly indebted to Messrs. Rowland Ward & Co. for the illustration reproduced above which shows the curious inflation of the nose and the peculiar position of the nostrils, the animal was shot by Mr. S. H. Miller. The dimensions of the horns are :—

Length 13″, Girth 5¼″, Tip to tip 3⅛″ ; they are light coloured.

In the autumn the summer coat of yellow fawn begins to assume a whitish tinge and in winter it is said to become pure white. The height of a buck is about 29 inches. Some are said to be taller.

II. Sub-family—*PANTHALOPHINÆ.*

Tibetan Antelope—*Pantholops hodgsoni.*

The *Chiree* of Ladak—*Tsus* and *Choosh* further northwards.

Habitat.—The great plateaux of Tibet. It is mostly met with by sportsmen in the Chungchenmo and during migrations in the Karakoram at elevations up to 18,000′ and seldom under 14,500′. Plate 1 shows the kind of ground on which the Chiree dwell.

The colouring varies according to season and not infrequently to a considerable extent in individuals. The face is brown, or at times nearly black, but above the nose there is nearly always a blackish patch. The accompanying plate does not show the curious swelling on the nose distinctly, this is very marked at all seasons of the year. The buck in the photo was shot before it had lost its winter coat : this coat consists of an extraordinarily dense mass of upright wool of a very pale brown colour often with a pinkish tinge ; when the dead body is handled this wool comes away in handfuls, it literally peels off in lumps—this is the protective portion of the winter coat and is the outside fleece, in this respect it differs from the Ibex and other upland animals, in which the *pushm* or *under fleece* provides the required warmth. The side of the head and neck are grey with sometimes a shade of brown. Inside the ears and the stomach are greyish white, the forelegs are partly blackish brown, and the hind legs are generally entirely of that colour, but in the colouring of the legs, there is often slight but distinct variation. Most of the buck I have shot were obtained in May, when the colour is hard to describe, they were ragged with part of the winter and part of the summer coat showing. One or two months later in the year the colour might be described as reddish light brown on the back.

On shooting a buck and carefully looking it over, the large inguinal glands will attract attention and the already mentioned thickening of the nose, also the coat of wool which is 2″ or more in depth. Compared with the black buck as to size, the Tibetan animal is larger, the skull, which has a large nasal cavity, is considerably longer and the height and length greater.

The following are measurements made in May and June.

Height including woolly coat.	Weight.	Horn.	Locality.
35″	85 lbs.	24″	Under the Demjor-lo
36″	85 lbs.	26½″	Kyam Changchano.
35″	90 lbs.	24″	Kieung-la.

Some writers put the maximum weight at 120 lbs. I doubt it, in the autumn probably all the three bucks mentioned might have increased by 10 lbs. but not more and many full grown animals are smaller. An average length of horn is 22″ to 24″ by 6″ girth. A female stood 28″ but another was nearly 30″. The record horns of the buck are I think 28″.

General Notes.—The small bore high velocity rifle makes the stalk much easier than it was years ago. Look at plate 1, and see the ground to be crawled over. There must be large numbers of this migratory antelope still existing, for immense herds were to be seen in favourable localities at certain seasons. When migrating they follow the same tactics as many of the Gazelles, the sexes separate and move in herds of many hundreds. When on the grazing land, they are found in flocks of from 3 to 10 or more, then they may get amongst the ravines, and into the fairly steep hill sides, but I have never seen an antelope on what could be called rocky slopes.

They are greatly pestered by Bot flies, on removing the skin, scores of the grubs of this fly are found, they do not penetrate the flesh.

At first Antelope steak is rather a welcome dish, but try it for every meal for six weeks and you will hate the mention of it for ever.

The statement so often made that the horns of Tibetan Antelope are in shape very similar is to a great extent true but there are exceptions. All horns have at times " freaks." Amongst a group of bucks was one with lyre-shaped horns which turned rather outwards and then curved inwards right up to the tips: the length was 20 inches. The bucks had scooped out the sand and I fondly hoped that the lyre-shaped horns might belong to some Gazelle, but all the same I was very pleased not to miss my shot when the Antelope stood up, until it did so there was nothing at which to shoot.

In a hollow in a hill side I found a single horn in a wolf's den, which was erect at first and then turned inwards rather abruptly, but this horn was short.

III. Sub-family—*ANTELOPINÆ.*

ANTELOPES—Genus—*ANTELOPE.*

THE BLACK BUCK OR INDIAN ANTELOPE—*Antelope cervicapra.*

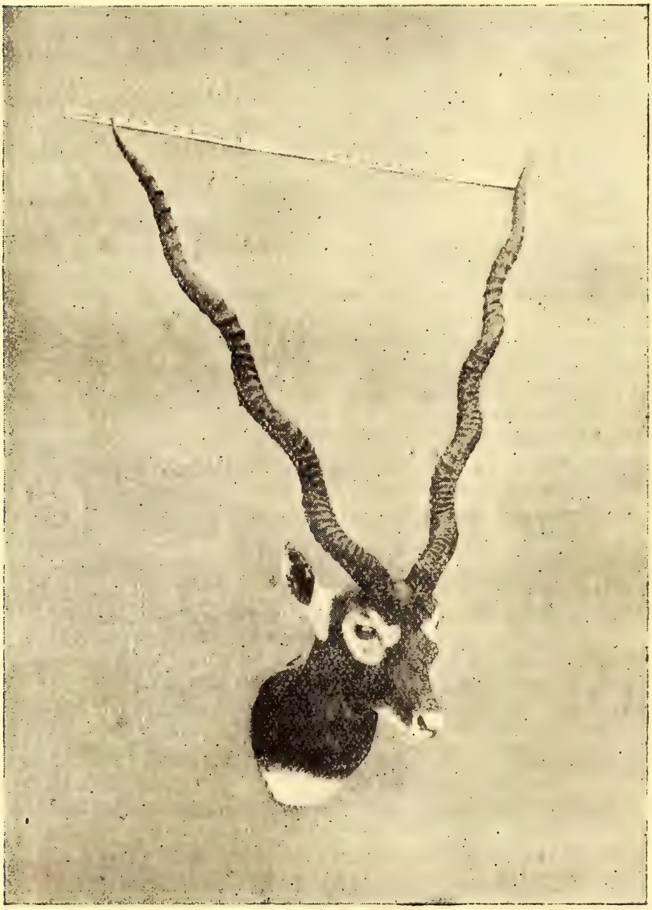


FIG. 2. THE BLACK-BUCK (*Antilope cervicapra*), **JHIND STATE.**
Right horn 30″; Left horn 31⅞″.

Hiran and *Herna* of the Dogras and in India.

So few Black Bucks are left near Jammu, the only province which interests the reader, that it is scarcely worth while to enter this Antelope in our lists.

Dunbar Brander in his " Wild Animals in Central India" gives a long description, and very interesting reading it is.

Unlike the Tibetan Antelope the suborbital glands are present. The inguinal glands though large are not nearly so much developed as in the Tibetan animal. The male when young is coloured fawn like the doe but gradually assumes a darker tone becoming practically black on the back making a sharp contrast with the white belly. There has been a good deal of correspondence regarding " brown-backed bucks ". Some fully matured animals with fine horns are for a long time brown.

The size of this Antelope seems to vary but little in the numerous districts it inhabits, the measurements given by Dunbar Brander.

Height at shoulder	Length	Weight
32″	4′	90lbs.

represent a well developed animal.

The photo of the head figured above, kindly supplied by the Bombay Natural History Society, is the record. Other horns are 30″, 29″, 28¾″.

Albinos are rare. I have however seen two in a wild state. There are several known instances of the female carrying horns. One I shot in the Moradabad District, U. P., had the horns lying flat close to the skull curving from the ears backwards.

As to the controversy regarding this Antelope drinking, they certainly do so in the hot weather—when camped on the borders of the Rewa State, close to jheel, both Chital and Black Buck came regularly to drink, of course Chital are thirsty animals, but Antelopes certainly drink.

As a rule the largest horns are found in certain fixed localities.

I never succeeded in getting a big head in Aligarh from amongst the enormous number seen, but curiously enough I shot a very fine head at Amsote not far from Hurdwar, and a head which measured nearly 30″ (horns) was killed between Fattehpur and Mohan, on the Saharanpur-Mussoorie road.

Many people have kept tame black buck, they are apt to be vicious. In a very large enclosure where Antelope, Chital, Sambhar and Hog Deer wandered, a very fine Black Buck was the one animal to be avoided, eventually it slew a male Hog Deer.

Fighting bucks were often kept by Indian princes, the animals are generally keen to go at one another, but as they are roped up by the keepers, and pulled back not much harm is done. Judging by the distance which a herd buck will in a wild state sometimes chase an interloper, the use of the rope in these encounters is probably a necessity.

GAZELLES—Genus—*GAZELLA.*

Lydekker when dealing with the gazelles of Ladak and Central Asia, in his book " The Game Animals of India, Burma and Tibet " adopted as his type for these Gazelles a race of the Persian species and called it *Gazella subgutturosa typica*, giving as his reason, that this was the only gazelle found within the area included in his book. These articles however go much further afield, so there is no reason to follow the same course.

I have endeavoured with all the information, coupled with what knowledge I have, to try and indicate the locality occupied by each race, but this is not easy, especially when dealing with the different allies of the ' *gutturosa gutturosa* ' type.

The Central Asian and Indian Gazelles included in the genus *Gazella* are divided into two subgenera as follows :—

I.—Sub-genus—Procapra.

includes the following species :—

1. Gazella (Procapra) picticaudata.
2. ,, ,, przewalskii.
3. ,, ,, gutturosa.
    2 races of No. 3 are recognised :—
    A. Gazella gutturosa gutturosa.
    B. ,, ,, altaica.

II. Sub-genus—Gazella.

4. Gazella sub-gutturosa.
    2 races of No. 4 are recognised :—
    A. Gazella sub-gutturosa sub-gutturosa.
    B. ,, ,, sairensis.
5. Gazella yarkandensis.
6. Gazella siestanica.
7. ,, fuscifrons.
8. ,, bennetti.

In order to follow the geography of the countries where these animals are found it will be necessary to look at the map of Ladak and of Sikkim and Southern Tibet for No. 1. Then that of Mongolia for No. 2. Turn to Western China for No. 3. Next for No. 4 part of the country from Asia Minor—Persia to China has to be studied. For No. 5 the maps of Yarkand and Kashigar suffice. It is rather a relief to look up Seistan bordering on Baluchistan and Afghanistan for No. 6 and 7, for these countries are near to India. While No. 8 is purely Indian.

Material aid will be got from Rowland Ward's 8th Edition of the Big Game Records, in regard to Kennion's Gazelle a specimen of which I have never seen in the body.

Some of the photographs from which the plates are herein produced are probably taken from the same specimens as in Lydekker's work for owing to the kindness of the British Museum, Colonel Harry Ward was able to give me a great deal of assistance (see part IV—Game Animals of Kashmir etc., page 882 of the Journal, 20 Dec. 1922) and took the photographs in the B. M. Other photos are reproduced from the B. M. Catalogue of Ungulate Mammals.

Sub-genus—Procapra.

Tibetan Gazelle—*Gazella* (*Procapra*) *picticaudata.*

Goa of Tibet ; *Ragao* in Northern Ladak.

Distribution.—This is the Gazelle which is best known to the majority of sportsmen who shoot on the borders of Central Asia. It is an inhabitant of Northern Ladak—Spiti and Tibet. It lives on the plateaux in the open country and is seldom seen on the mountain sides, it does not descend in Ladak much below 14,000′, and is found at higher elevations in summer time.

Colour.—The plateaux of Tibet are very hot at midday and the winters are intensely cold, hence as must be expected, the Goa assumes a long coat at the latter season, this is a grizzled and sandy colour. In summer the hair is pale rufuous and comparatively short. The buttocks are white, the tail is dark brown and very short : the disc round the tail is white. The lower parts are lighter than the back and gradually merge into almost pure white underneath. No suborbital gland, or knee tufts. Females hornless. Height at shoulder 23 to 24″—weight 40 to 45 lbs. The horns are much curved backwards then slightly forward at the tips and are covered with rings almost to the top.

Notes.—It is rare to see more than 8 to 12 in a herd. In the country, more accessible to most sportsmen, this gazelle is scarce, and does not appear ever to collect in large flocks.

Blanford quotes a recorded length of horn at "15·75," measured along the front curve, and a basal girth of 4″. This length is very great and Ludlow's trophy of 14⅛″ by 3¾″ has not I believe been excelled in recent dates.

PRZEWALSKII'S GAZELLE—*G. (Procapra) przewalskii.*

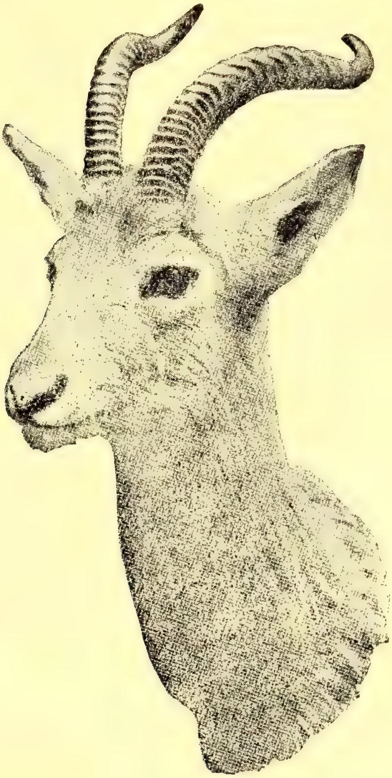


FIG. 3.—Prezewalski's Gazelle (*Gazella (Procapra) przewalskii*).

Distribution.—This Gazelle is said to have its habitat in parts of China from Kansu northwards to the bend of the Yellow river, and also in Mongolia—also eastward to the north of Pekin.

Notes.—The head figured above is that of an animal in winter coat and is reproduced from the B. M. Catalogue. The pronounced inward turn of the horns at the tips appear to form a character by which it is considered a distinct species. The most that can be said in support of this distinction is the shape of the horns and the large size.

It closely resembles the Goa, perhaps in summer it is rather more brown.

Females are hornless.

The bucks carry horns of about 12″ in length, and these are rather stouter than those of the Goa.

THE MONGOLIAN GAZELLE—*Gazella* (*Procapra*) *gutturosa*.
The *Hwung—Yang* or Yellow Goat of China.
The *Djeron—Terrev* (Turki).

These names are however employed locally for most of the Gazelles. If the Altai animal is distinct the following two races may be recognized, *i.e.*, *Gazella gutturosa gutturosa* and *Gazella gutturosa altaica* :—

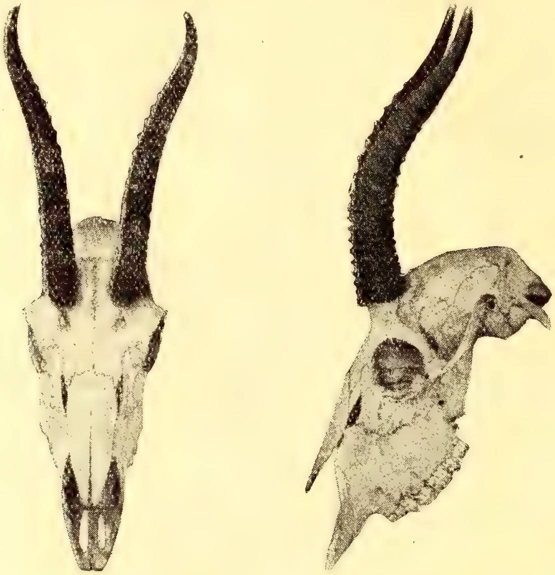


FIG. 4. Mongolian gazelle—(*G. gutturosa gutturosa*).

The name *gutturosa* was given because the throat of the bucks swells during the pairing season, this is due to the dilation of the larynx which gives a swollen appearance to the upper portion of the neck.

Distribution.—The habitat of the typical race *gutturosa gutturosa* is Northern and North-East Mongolia to the vicinity of the Gobi desert, to the hills northward of the Tian-Shan and also to the north and north-east of Pekin. A closely allied race comes from part of the Altai.

Notes.—The Mongolian Gazelle is as far as is known the largest of any of the Central Asian races. One shot north of the Gobi measured 28″, a second 27½″, in some books it is stated that this Gazelle stands as high as 30″ at the shoulder.

The skulls illustrated show the heads of the typical race *gutturosa gutturosa.*

The tail is very short like that of the Goa. There are indications of knee tufts. No face marking. The rump is white. Females are hornless. A good pair of horns on an old buck measured 12″ in length by 4½″ in girth, they are of a greyish brown hue, and are stout and strong.

This is not a " Gazelle of the desert " nearly to the same extent as are other races, nor is it addicted to resting during the day in an open bare grassless plains. Unless much worried by men or wolves, it does not penetrate far into the hills, but is found on grass flats and in the ravines in the lower hills.

Like the Tibetan Antelope and some of the Tibetan Game Animals, the does congregate in the spring, the herds running into many hundreds, they then move into reasonably good and open grazing ground, there in May and June the young are born : wonderfully active the little creatures are, and they need to be if the wolves are not to take too heavy a toll.

The late Ney Elias mentions coming across herds of hundreds all the way from the bend of the Yellow river to the Altai—most of these were probably the Mongolian Gazelle, though some were probably *G. procapra przewalskii*: this was about 40 years ago—and it was from that intrepid traveller's specimen of this Gazelle that Blyth gave the name "*procapra gutturosa*." It was about 1879 that Biddulph shot a then unknown Gazelle on the Maralbashi country, this must have been the Yarkand race (the "Saikik").

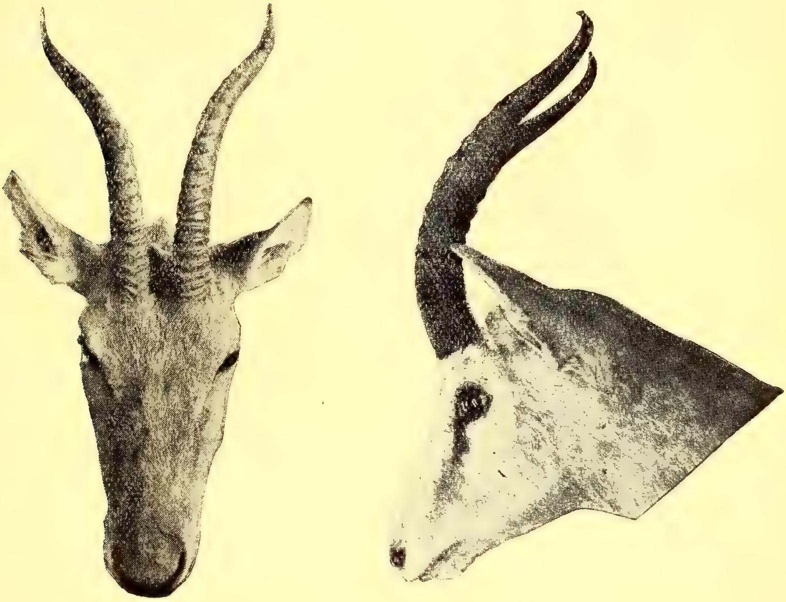


Fig. 4. Altai Gazelle—*Gazella gutturosa altaica.*

Distribution.—The typical locality of the Altai race (*G. gutturosa sairensis*) is given as the "Suok Plains near the little Atlai, N. W. Mongolia. The photos above illustrate the Altai race. The colour of the animal is a light fawn with pale cheeks, the small suborbital glands are to be seen. The face is devoid of markings.

The record horns are I believe just under 14″ and I see Rowland Ward quotes 13¾″ by 4¾″. The horns of the specimen figured above are 11 inches.

Sub-genus—Gazella.

The Goitered Gazelle—*Gazella sub-gutturosa.*

Persian name "Ahu".

The various races of the Goitered Gazelle wander over a very large area in Asia Minor, Northern Persia, the Caspian Provinces—Turkestan and parts of China proper.

G. sub-gutturosa is essentially a desert animal and is found in small herds, which probably do not get together except when migrating. They have not the habit of going much amongst broken country and are hard to stalk. They are often found in the open desert during the day time.

It is hard to give the limits of the habitat of the races and still harder to say when the variations are sufficiently constant and marked to separate the races or tend towards establishing a distinct species. Two races are recognised :—(A) *Gazella subgutturosa subgutturosa* and (B) *Gazella subgutturosa sairensis.*

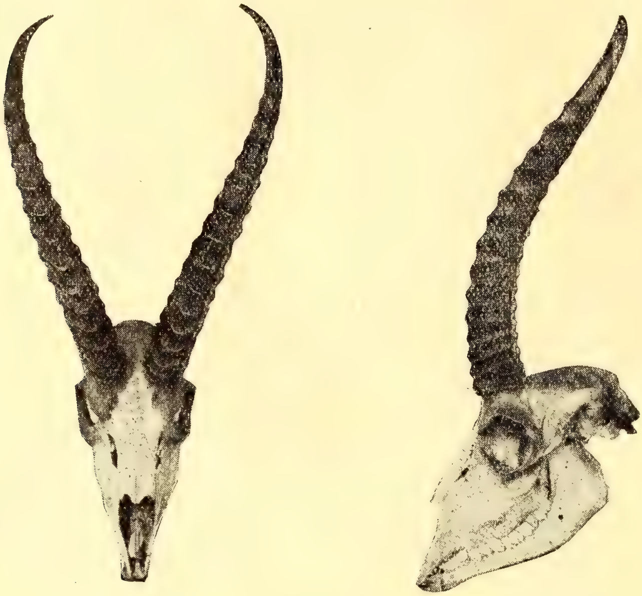


Fig. 6. (*a*) Goitered Gazelle (*G. subgutturosa sub-gutturosa*).

The Goitered Gazelle (*G. S. sub-gutturosa*) is the typical race from Persia and the Caspian.

The Goitered Gazelle stands about 26″ at the shoulder, thus it is considerably larger than the Goa, and is smaller than the Mongolian gutturosa gazelle.

The photo above shows heads of the typical Persian race, these specimens are in the Hume collection.

The tail is long, and measures about 8 inches, it is dark coloured. Knee tufts are well developed, cheek marks are more or less clearly defined; suborbital and groin glands exist.

Colour.—The colouring of the upper parts is rufuous, the lower parts lighter, buttocks white, with a clear brown line separating the white from the rufuous fawn above and at the sides. On the younger bucks a dark line extends from below the eyes to the base of the horns and there joins, and forms a frame to the white or pale fawn on the upper part of the face but this marking is faint on old bucks. The bucks appear to carry finer and less stumpy horns than the Mongolian race. The horns of a good specimen tape 14½″ with a girth of 4½″ with the ridges clearly marked.

The second race of goitered gazelle (*G. subgutturosa sairensis*) is the form from N. W. Mongolia.

Jairam of Turkistan.

The typical locality of the race is given as "Saiar, or Jair Mountains, Zungaria.

The Gazelle of the Saiar is larger than the typical Persian race, standing 27″ at the shoulder but with smaller horns.

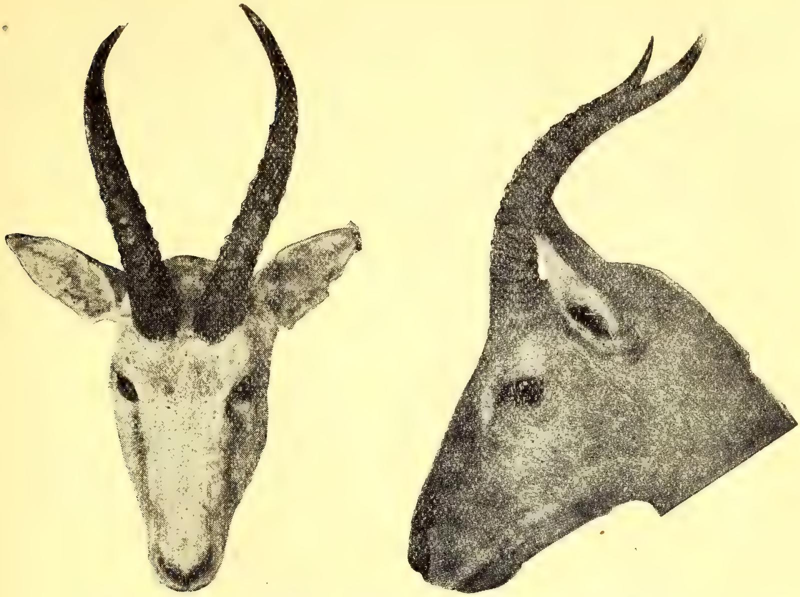


Fig. 7. (*b*) Sair Goitered gazelle (*Gazella subgutturosa sairensis*).

The heads figured show distinctly the dark lines under the eyes but the face in front is devoid of the markings or nearly so, they were probably bucks killed in the winter.

Fig. 6. shows a typical but very fine pair of horns, for as a rule the Gazelle from the Sair carries a poor head.

The Yarkand Gazelle—*Gazella yarkandensis.*

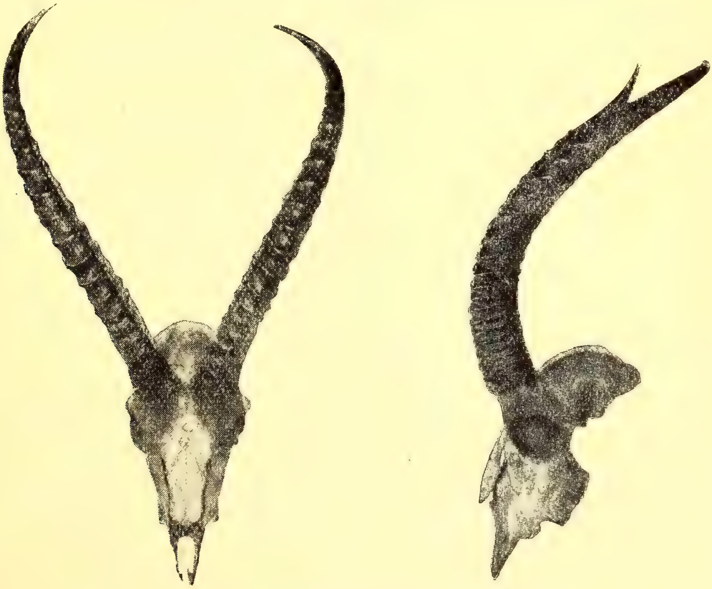


Fig. 8. Yarkand Gazelle (*Gazella yarkandensis*).

The *Jeron* or *Saikik.*

Distribution.—The Type locality is given as the "plains of Yarkand, Chinese Turkestan." This Gazelle is found in the vicinity of Kashgar and Yarkand and eastward of the Khotan river to the Tarim country and Lob-nor, this is the country to the southward and westward of the habitat of the Mongolian species. It is a large sized gazelle.

The ears are long and the face markings very pronounced, unfortunately I have no photograph of a set up head.

The colour above is fawn, so also is the forehead, in this it differs from other allied races.

The Gazelles afford sport to hawking parties, in Kashgar an eagle is flown which pitches on the head of a doe and pecks viciously, whilst the flapping of its wings bewilders the gazelle, and enables the horsemen to ride up and catch it. Hawking used to be a very popular recreation in many parts of Central Asia.

Fig. 7 illustrates a head in the Hume Collection, it represents a very fine specimen. The horns, 16″ in length, are densely ridged which was not always the case in the Yarkand specimens first obtained in 1879.

The record horns are I believe those figured in Rowland Ward's Eighth Edition of records, page 237, they are 17″—4½″.

THE SEISTAN GAZELLE—*Gazella seistanica.*

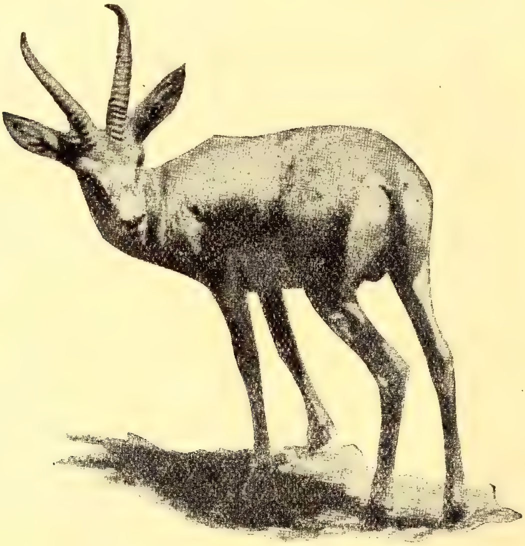


FIG. 9. Seistan Gazelle (*Gazella seistanica*).

Distribution.—Apparently Northern and Eastern Persia.

The Type locality is given as " Seistan, Eastern Persia "

This, I take it, is the name now given to the gazelle which is found in Seistan, to the north-west of Baluchistan and to the south of Afghanistan. It is figured in Rowland Ward's Records, and the locality of the recorded heads are Northern Persia.

The bucks appear to carry horns which are generally smaller, but rather resemble those of *yarkandensis*, see photo of *yarkandenisis.*

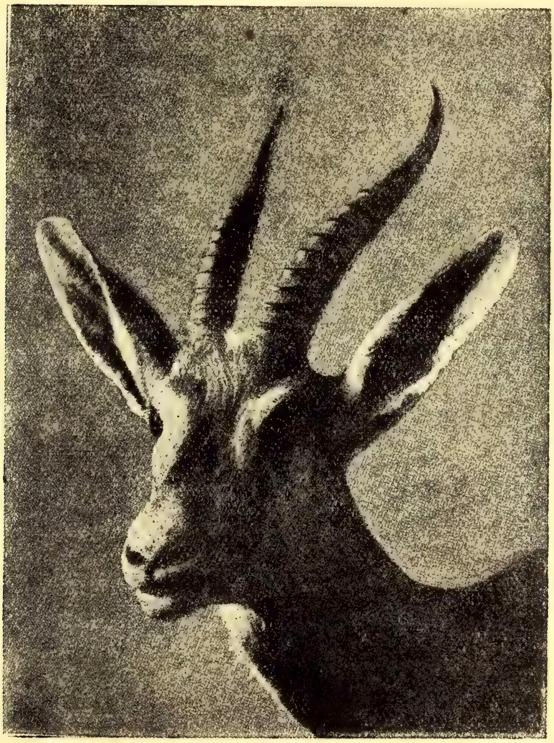
I was under the impression that the gazelles which were very occasionally to be seen and still more rarely to be shot to the westward of the Peshin Valley were the same as this animal—but I have not enough to go upon. However *seistanica* is described in the British Museum Catalogue as being " closely allied to *yarkandensis* "; and although *yarkandensis* and *seistanica* are now regarded as distinct species I am however inclined to adhere to the original idea that these gazelles are merely races of *G. subgutturosa sub-guttturosa.*

At the risk of boring the readers of the Journal I propose to dwell on the recorded distinctions between *yarkandensis* and *seistanica,* the most noticeable is the " white muzzle of the latter." Next the forehead is sometimes greyish in *seistanica,* this is a slight difference and may be simply "old age," and there is a whitish band at the base of the horns and an indistinct nose spot above the white muzzle. I have never seen this on any specimen of a Yarkand Gazelle. As to the smaller amount of white on the buttocks in *seistanica,* there is no doubt that the white varies in different individuals of *yarkandensis* but it has to be admitted that the small extent of white if constant, creates a difference, because the tendency towards white is one of the distinguishing features of the Seistan animal. Still it would appear as if the evidence to justify establishing distinct species amongst many of the Central Asian animal is not sufficient.

At one time I was in correspondence with an eminent American Naturalist who deplored the hasty decisions to sub-divide species, but, as he remarked, " it is easier to do this, than to rectify the error when done."

The animal figured above is from a photo by Col. Kennion and is reproduced from the B. M. Catalogue.

Kennion's Gazelle—*Gazella fuscifrons.*



No. 10. Kennion's Gazelle (*Gazella fuscifrons*).
From Lydekker, *Proc. Zool Soc.* 1911.

Distribution.—Seistan and the borders of Baluchistan.

This Gazelle is, as far as I can ascertain, closely allied to the Chinkara. The female carries horns of considerable length which have frontal ridges. Apparently the horns tend towards a turn inward at the tips and the maximum length of a buck's horns is about 14 inches.

I have not had the pleasure of meeting Col. Kennion since he shot this gazelle and have not in consequence been able to get any information In the B. M. Catalogue of Ungulates Kennion's gazelle is described as being "apparently somewhat smaller than *siestanica*" (shoulder height probably about 28″), the male is without a 'goitre'. There is no marked inturning of the horns as in *siestanica.* I have already commented on the colour differences.

THE INDIAN GAZELLE—*Gazella bennetti.*

No. 11. Indian Gazelle (*Gazella bennetti*).

THE *Chinkara* OR "RAVINE DEER" OF SPORTSMEN.

In former years a few of these Gazelles were to be found in the foot hills bordering on the Punjab, they have now been practically shot out from South and South East of Jammu—hence it is only in Baluchistan and in Persia, to the West of Khelat, that this Indian Gazelle is found in the country mentioned in these articles.

Male.—Height at shoulder 25″, at croup 28″ (from a big buck), length 40″ to 42″—the ear is about 6″ long—horns 11″ to 14″—record 15¾″—weight from 45 lbs. to a little over—horns rather upright, curve quickly backward and slightly forward at tips, which are from 4″ to 8″ apart.

Female.—Weight 30lbs.—horns from about 5″ to 7″— as long as 8″ are recorded.

I have not kept records of many measurements, and have in fact only shot one female which was of the weight mentioned. The horns of the male have many ridges almost to the tips—those of the females are generally devoid of these rings or ridges but are not invariably smooth. I saw a pair of horns in Quetta and in Peshin which were distinctly ridged. Dunbar Brander mentions that female Chinkara in certain localities in the C. P. carry annulated horns.

Colour.—The colour of the upper part is a fawn chestnut, the chin and lower parts and inside the thighs white. Tail blackish. The knee tufts generally very dark brown, the white caudal disk, which is present in the Tibetan Gazelle, is absent in the Chinkara. Face markings of white with a rufuous border and from the horns to above the nostrils a darker tinge of rufuous.

Some of the Northern India animals are very much paler in colour, and the gazelles of S. E. Persia seem to be closely allied.

General Notes.—Chinkara are gregarious, it is however rare to see more than half a dozen together. They inhabit broken ground and eschew the open plains, thus differing in their habits from their Central Asian allies. It is not at all uncommon to see twins—but probably one young one at a birth is the general rule. With a light small bore rifle the pursuit of this dainty gazelle is rather an entrancing kind of sport which can be indulged in without going into camp, the drawback is that this animal does not show up well in the daytime, for it generally rests until late in the evening. Outside the area with which we are now concerned Chinkara are found in most parts of Northern India and southwards into Mysore.

The photograph is by Major C. H. Stockley.

Sub-family—*TRAGELAPHINAE.*

Genus—Boselaphus.

The Nilgai (*Bosephalus tragocamelus*), *Portax pictus* of Jerdon.

This well known animal is common in Jammu, it is sometimes called *Roz* but *Nil* is the common name.

This is the only representative of the subfamily in India, for others we have to turn to Africa.

The suborbital glands are present, so are the interdigital, there are no inguinal glands.

Colour.—The colour of a bull is either bluish brown or bluish grey, the female is a brownish grey, both sexes have white on the cheeks, and white rings on the legs above and below the fetlock. The stomach is whitish and there is a white throat patch. There is a tuft of black hair on the throat of the male and both sexes have manes. The young are brown. The female is hornless. The male carries horns of 8″ to 9″ long and about 8″ in girth. A very exceptionally long horn was 11¾″. Two heads of 12″ have been recorded in the Society's Journal.

Measurements of a large bull shot in Kumaon.

Height.	Length.	Tail.	
54″	86″	18″	exclusive of the tuft.

The weight was about 580 lbs., but the scale was not very accurate when weighing heavy animals.

General Notes.—Nilgai live in the so-called Game reserves in Jammu, and wander where they please. As a rule they live in the scrub jungle during the day, but in the mornings and evenings and sometimes throughout the day they graze in the fields. Much damage has been done by the herds of Nilgai hence they are now out of favour, but until lately the mantle of sacredness has protected them.

A big blue bull is often solitary, otherwise Nilgai are seen in small herds.

How deceiving the lumbering gallop of the bull is! It takes a good horse to overtake a Nilgai, and a very good one to run down a female but if on easy ground both can be ridden down and speared. When at all hemmed in the blue bull will charge if wounded. I can remember being out on two occasions when this occurred.

We were riding in line through a detached piece of grass looking for a wounded bull which got up between two horses and made straight at the nearest, luckily on the right side. On the other occasion I did not see the charge, but one horse was upset though not damaged. In captivity they are dangerous. There is a grim satisfaction in shooting females and even young Nilgai, for they are absolutely pestilential in the crops. Certain parts of Kumaon jungles hold numbers—any way they are not wasted when dead for the Mahouts will eat them although they do not appreciate an old bull, but for the skin they get rupees, hence they are quite ready to load the carcass on to a pad elephant.

(*To be continued.*)

BOMBAY NATURAL HISTORY SOCIETY'S MAMMAL SURVEY OF INDIA, BURMAH AND CEYLON.

REPORT NO. 37(*a*), NEPAL.

BY

T. B. FRY.

COLLECTION	No. 37(*a*).
LOCALITY	Nepal.
DATE	May 17, 1922 to May 17, 1923.
COLLECTED BY	N. A. Baptista.

A Collection made by Col. R. L. Kennion between August 19 and December 23, 1920, and another by N. A. Baptista between January 17 and April 20. 1921. were examined and commented upon by Mr. M. A. C. Hinton in Report No. 37* (Nepal); and in addition to considering the actual specimens obtained he wrote very fully on the known fauna of this country.

Later during the period May 17, 1922, to May 17, 1923, Mr. Baptista working in the districts lying to the west of Katmandu collected some 591 specimens, most of which belong to species to which reference was made in the above mentioned Report; in fact only two new species were discovered, *viz.*, *Apodemus* (*Nemomys*) *gurkha* described by Mr. Thomas in "Scientific Results," and *Neodon sikimensis*, to which attention will be drawn under their respective headings.

In view of the foregoing facts no detailed report of this Collection appears to be necessary so the following List only, with occasional remarks, is submitted for publication in the Society's Journal.

(1) MACACA MULATTA, Zimm.

The Bengal Monkey.

(Synonymy in No. 7).

Chengli, ♂ 1 ; Bouzini, 5,000′, ♀ 1.

" Found in large troops in Nepal, not sacred, period of gestation about six months, usually only one young at a birth, do much damage to crops.

"Vernacular names :—*Ratto Bandar* (Pahari) ; *Mugger* (Bhotia) "—*N. A. B.*

(2) PITHECUS SCHISTACEUS, Hodgs.

The Himalayan Langur.

(Synonymy in No. 15.)

Satthar, 11,000′-12,000′, ♂ 1.

" These animals are said to pair in February and the young to be born in May, but this needs verification. They are not destructive to crops like other monkeys."—*N. A. B.*

(3) ROUSETTUS LESCHENAULTI, Desm.

The Fulvus Fruit Bat.

(Synonymy in No. 11.)

Boitari, ♂ 4, ♀ 4.

(4) CYMOPTERUS SPHINX, Vahl.

The Southern Short-nosed Fruit Bat.

(Synonymy in No. 6.)

Satthar, 12,000′, ♂ 3, ♀ 1.

" Common in Nepal, frequently found on plantain trees. It breeds in December. Eaten by Passis only."—*N. A. B.*

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* Jour. Bom. Nat. Hist. Soc., Vol XXIX, p. 399.

(5) RHINOLOPHUS AFF. HIMALAYANUS, K. And.

The Himalayan Horse-shoe Bat.

(Synonymy in No. 37.)

Bouzini, 5,000′, ♂ 1.

(6) RHINOLOPHUS LUCTUS PERNIGER, Hodgs.

The Great Black Horse-shoe Bat.

(Synonymy in No. 14.)

Banss Bahari, ♂ 1 ; Bouzini, 3,000′, ♀ 1.

(7) RHINOLOPHUS ROUXI, Temm.

The Rufous Horse-shoe Bat.

Sipuri, 6,000′-8,000′, ♂ 1.

(8) HIPPOSIDEROS ARMIGER, Hodgs.

The Great Himalayan Leaf-nosed Bat.

(Synonymy in No. 14.)

Hathiban, 5,000′, ♀ 5 ; Bouzini, 5,000′, ♂ 1, ♀ 4; Bachek, ♂ 3, ♀ 5
Dano Kharka, 12,000′, ♀ 4 ; Bachek, ♂ 3, ♀ 5.

(9) PIPISTRELLUS BABU, Thos.

The Babu Pipistrel.

(Synonymy in No. 26.)

Bouzini, 5,000′, ♂ 2 ; Sipuri, ♀ 1.

(10) MYOTIS SICARIUS, Thos.

The Sikkim Myotis.

(Synonymy in No. 26.)

Banss Bahari, ♀ 4.

(11) SORICULUS CAUDATUS, Horsf.

The Sikkim Brown-toothed Shrew.

(Synonymy in No. 15.)

Satthar, 12,000′, ♂ 1 ; Apoon Hill, 12,000′, ♂ 1, ♀ 3 ; Apoon Sottadanda, 12,000′, ♂ 1.

" Very common at about 12,000′ ; trapped on steep rocky banks. Vernacular :—*Chichunder* (Nepalese), *Reimboo* (Bhotia)."—*N. A. B.*

(12) SORICULUS NIGRESCENS CENTRALIS, Hint.

The Nepal Dusky Shrewlet.

(Synonymy in No. 37.)

Satthar, 12,000′, ♀ 1; Bouzini, 5,000′, ♂ 4, ♀ 5 ; Sipuri, ♂ 1 ; Tarro Bir, ♂ 1.

Probably rarer than *S. caudatus.*

(13) PACHYURA, sp.

Gorkha, ♂ 1, ♀ 1 ; Chengli, ♂ 1 ; Deorali, ♂ 1 ; Boitari, ♀ 2 ; Doromdanda, 12,000′, ♂ 1.

This genus has still to be studied. Eventually it may be found that two or three distinct species occur in Nepal.

(14) Pachyura perrotteti, Duvern.

The Indian Pigmy Shrew.

(Synonymy in No. 4.)

Knaping, ♂ 1.

Probably comparatively rare but owing to its small size it may easily escape notice.

(15) Felis affinis, Gray and Hardw.

The Jungle Cat..

Hathiban, 5,000′, ♂ 2 ; Syartang, ♂ 1 ; Satthar, 12000′, ♂ 1 ; Mircourt, ♂ 1, ♀ 2 ; Knaping, ♂ 2, ♀ 1 ; Manglopani, ♀ 1.

(16) Viverra zibetha, L.

The Large Indian Civet.

(Synonymy in No. 14.)

Banss Bahari, ♂ 1 ; Gorkha, ♂ 1 ; Chengli, ♀ 1 ; Boitari, ♂ 1, ♀ 1 ; Satthar, 12,000′, ♀ 2 ; Syartang, ♂ 2, ♀ 2 ; Mircourt, ♀ 2.

(17) Paguma grayi, Benn.

The Himalayan Palm Civet.

(Synonymy in No. 15.)

Hathiban, 5,000′, ♀ 1 ; Bachek, ♀ 1.

(18) Herpestes auropunctatus, Hodgs.

The Small Indian Mongoose.

(Synonymy in No. 27.)

Hathiban, 5,000′, ♂ 1, ♀ 1.

(19) Herpestes nipalensis, Gray.

The Small Bengal Mongoose.

(Synonymy in No. 19 under *H. auropunctatus.*)

Sepetar, ♂ 1 ; Boitari, ♀ 1 ; Satthar, 12,000′, ♂ 1 ; Knaping, ♀ 1 ; Syartang, ♂ 1 ; Mircourt, ♂ 2, ♀ 1 ; Manglopani, ♂ 1.

H. nipalensis differs but slightly from *H. auropunctatus*, the grizzling being finer and the under parts lighter coloured, but it is note-worthy that the two forms are found in Nepal.

(20) Herpestes urva, Hodgs.

The Crab-eating Mongoose.

(Synonymy in No. 23.)

Gorkha, ♀ 1 ; Chengli, ♀ 1 ; Boitari, ♀ 1.

(21) Canis indicus, Hodgs.

The Jackal.

(Synonymy in No. 1. under *C. aureus.*)

Hathiban, 5,000′, ♂ 2 ; Syartang, ♀ 1 ; Doromdanda, 12,000′, ♂ 1, ♀ 1.

" Destructive among poultry, and does damage to corn and sugar-cane "—*N. A. B.*

(22) CHARRONIA FLAVIGULA, Bodd.

The Northern Indian Marten.

(Synonymy in No. 15.)

Sepetar, ♂ 1 ; Satthar, 12,000′, ♂ 1, ♀ 2 ; Mircourt, ♀ 3 ; Apoon Hill, 12,000′, ♂ 1, ♀ 3 ; Knaping, ♀ 1 ; Syartang, ♀ 1.

(23) MUSTELA SUBHEMACHALANA, Hodgs.

The Himalayan Weasel.

(Synonymy in No. 23.)

Barpak, ♂ 1.

"Lives on small birds and eggs."—*N. A. B.*

(24) PETAURISTA CANICEPS, Gray.

The Grey-headed Flying Squirrel.

1842. *Sciuropterus caniceps*, Gray, A. M. N. H., x., p. 262.
1843. *Sciuropterus senex*, Hodgson, J. A. S. B., xiii, p. 68.
1889. *Pteromys caniceps*, Blanford, Mamm., No. 231.

Apoon, 12,000′, ♂ 4, ♀ 1 ; Barpak, ♂ 1, ♀ 2.

(25) PETAURISTA MAGNIFICUS, Hodgs.

Hodgson's Flying Squirrel.

1836. *Sciuropterus magnificus*, Hodgson, J. A. S. B., v., p. 231.
1842. *Sciuropterus nobilis*, Gray, A. M. N. H., x., p. 263.
1844. *Sciuropterus chrysothrix*, Hodgson, J. A. S. B., xiii, p. 67.
1889. *Pteromys magnificus*, Blanford, Mamm., No. 229.

Satthar, 12,000′, ♂ 5, ♀ 2.

(26) PETAURISTA NOBILIS, Gray.

The Himalayan Flying Squirrel.

(Synonymy in No. 23.)

Tarro Bir, ♂ 1.

This and the foregoing squirrel are much alike, but each shows certain well marked characters, which appear to be stable and not merely seasonal, which suffice to distinguish the one from the other.

(27) DREMOMYS LOKRIAH LOKRIAH, Hodgs.

The Orange-bellied Himalayan Squirrel.

(Synonymy in No. 20.)

Sipuri, 6,000′-8,000′, ♂ 1 ; Satthar, 12,000′, ♂ 1, ♀ 2.

(28) TOMEUTES LOKROIDES, Hodgs.

The Hoary-bellied Himalayan Squirrel.

(Synonymy in No. 23.)

Hathiban, 5,000′, ♀ 2 ; Chengli, ♂ 1 ; Kuwapani, ♂ 2, ♀ 2.

(29) BANDICOTA NEMORIVAGA, Hodgs.

The Bengal Bandicoot.

(Synonymy in No. 19 under *B. elliotana.*)

Manglopani, 12,000′, ♂ 1.

(30) GUNOMYS BENGALENSIS, Gray and Hardw.

The Bengal Mole-Rat.

Chengli, ♂ 2 (1 juv.), ♀ 1 ; Mircourt, ♂ 1 ; Syartang, ♂ 1.

"Eaten by most people."—*N. A. B.*

(31) RATTUS EHA, Wr.

The Spectacled Rat.

(Synonymy in No. 23.)

Apoon Hill, 12,000′, ♀ 1.

Eighteen specimens of this rat were collected in Sikkim by Mr. Crump, and were recognised as a new species by the late Mr. Wroughton.

(32) RATTUS FULVESCENS, Gray.

The Chestnut Rat.

(Synonymy in No. 15.)

Bouzini, 5,000′, ♂ 2, ♀ 2 ; Apoon Hill, 12,000′, ♂ 2, ♀ 1 ; Satthar, 12,000′, ♂ 2, ♀ 1.

(33) RATTUS NIVEIVENTER, Hodgs.

The White-bellied Rat.

(Synonymy in No. 15.)

Satthar, 12,000′, ♂ 2, ♀ 2.

(34) RATTUS RATTUS BRUNNEUSCULUS, Hodgs.

The Common Nepal Rat.

1845. *Mus brunneusculus*, Hodgson, A. M. N. H. (1), xv, p. 267.
1889. *Mus rattus*, Blanford, Mamm., No. 272.

Gorkha, ♂ 1, ♀ 2 ; Chengli, ♂ 5, ♀ 3 ; Deorali, ♂ 1 ; Syartang, ♂ 1 ; Manglopani, 12,000′, ♂ 1, ♀ 1.

(35) RATTUS RATTUS RATTOIDES, Hodgs.

The Nepal House Rat.

(Synonymy :—See *R. brunneusculus.*)

Satthar, 12,000′, ♀ 1.

(36) MUS HOMOURUS, Hodgs.

The Himalayan House Mouse.

(Synonymy in No. 15.)

Satthar, 12,000′, ♂ 2, ♀ 1 ; Apoon Hill, 12,000′, ♀ 1 ; Barkek, ♂ 1 ; Syartang, ♂ 3, ♀ 2 ; Laprak, ♂ 1.

The name *M. homourus* has been retained to distinguish this bluish-bellied mouse from the darker form *M. urbanus.*

(37) MUS URBANUS, Hodgs.

The Common Indian House Mouse.

(Synonymy in No. 5.)

Bouzini, 5,000′, ♂ 1.

This dark-bellied mouse has been noted in various Reports as *M. manei, M. dubius and M. urbanus* but it has lately been settled that the last name should be accepted for the present.

(38) APODEMUS (NEMOMYS) GURKHA, Thos.

The Nepal Apodemus.

1923. *Apodemus* (*Nemomys*) *gurkha*, Thomas, J. B. N. H. S. Vol. XXIX, p 888.

Satthar, 12,000′, ♀ 1 ; Apoon Hill, 12,000′, ♂ 2 ; ♀ 2 ; Apoon Sottidanda, ♀ 2 ; Barpak, ♂ 2 ; Laprak, ♂ 4, ♀ 3.

Mr. Thomas published a description of this new species in the Journal under "Results."

(39) NEODON SIKIMENSIS, Hodgs.

The Flower Mouse of Sikkim.

1849. *Neodon sikimensis*, Hodgson, A. M. N. H. (2), iii, p. 203; genotype, *N. sikimensis.*

1863. *Biscunedens*, Hodgson, in Gray Cat. Spec. and Drawings, Mamm. and Birds, etc., of Nepal and Tibet, Brit. Mus., ed. 2, p. 2 ; genotype, *B. perfuscus* apparently a M. S. name for *N. sikimensis. Arvicola, Microtus*, and *Pitymys* of later authors.

Apoon Hill, 12,000, ♂ 1.

In January 1923 Mr. M. A. C. Hinton after studying a large number of voles collected by Mr. G. Forrest in Yunnan published a paper in the Ann. and Mag. N. Hist. Ser. 9, Vol. xi, p. 145, in which he revived the name *Neodon.*

"The name *Neodon*, applied long ago by Hodgson to the Flower Mouse of Sikkim (*Microtus sikimensis*, of current literature), is available for this genus, since this species proves on examination to be a conspicuous member of the group, although its characters and relationships have hitherto been but imperfectly understood."—*M. A. C. H.*

The present specimen is rather young and cannot be satisfactorily distinguished from *N. sikimensis* and it is therefore hoped that more specimens from Nepal may be forthcoming.

(40) LEPUS RUFICAUDATUS, Geoff.

The Common Indian Hare.

(Synonymy in No. 15.)

Bouzini, 5,000′, ♂ 2, ♀ 2 ; Sipuri, ♂ 1, ♀ 1 ; Deorali, ♀ 1 ; Boitari. ♀ 1 ; Syartang, ♂ 1, juv.

(41) OCHOTONA ROYLEI NEPALENSIS, Thos.

The Nepal Mouse Hare.

Satthar, 12,000′, ♂ 3, ♀ 2 ; Apoon Hill, 12,000′, ♀ 1 ; Apoon Sottidanda, ♂ 4, ♀ 6 ; Barpak, ♂ 7, ♀ 4.

(42) NEMORHAEDUS HODGSONI, Pocock.

The East Himalayan Goral.

(Synonymy in No. 37.)

Deorali, ♂ 1, ♀ 1 ; Apoon, 12,000′, ♂ 1.

(43) MUNTIACUS VAGINALIS, Bodd.

The Bengal Rib-faced Deer.

(Synonymy in No. 2.)

Banss Bahari, ♂ 1 ; Chengli, ♂ 1 ; Doromdanda, 12,000′, ♀ 1 ; Deorali, ♂ 1 ; Mircourt, ♀ 1.

(44) MOSCHUS MOSCHIFERUS, L.

The Indian Musk Deer.

(Synonymy in No. 23.)

Apoon Hill, 12,000′, ♂ 1.

EARLY STAGES IN THE DEVELOPMENT OF SOME FRESH WATER FISHES IN THE PUNJAB.

BY

M. Hamid Khan, M. Sc., F.R.M.S.

With three plates.

Material for study was collected during the breeding seasons of 1921-24 from Departmental farms at Madhopur, Chhenawan, and from different places near the River Beas. The specimens were examined in the living state under a microscope and fixed in different reagents for further study. It is, however, intended to give in these pages a bare outline of the early stages, without going into microscopical details, with a view to help a fish-culturist " to differentiate between the successive ages and stages of growing fish, and between fry of the same age, belonging to species, which may be closely allied zoologically, though far apart economically "(17).

Ophiocephalus marulius is taken as a type of the *Ophiocephalidœ, Wallago attu* of the *Siluridœ,* and *Labeo gonius, Cirrhina mirgala* of the *Cyprinidœ.*

Ophiocephalus marulius.

Freshly laid eggs were taken from the pond, and kept in a live-car under observation, and their growth and development was from time to time compared with those in the pond.

Outline of the embryo becomes defined within twelve hours. The embryo appears on the left side of the yolk in a belt-like manner. The tail end is swollen, transparent and granular, while the head end is darker. Overnight stage shows the appearance of unpigmented eyes, auditory vesicles and heart. Just before hatching, heart gives off aorta, which passes dorsally to the posterior end to turn back into caudal vein. The latter vessel passes *in toto* into subintestinal vessel just near the attachment of the tail to yolk sac. Subintestinal vessel is formed by the vitelline veins which receive yolk capillaries, and anteriorly open into the heart. Anterior caudal vein brings blood from head, and emerges from behind the auditory vesicle, and breaks up into a set of venous spaces, which together with vitelline network spreads over the surface of the yolk and then goes to the heart (Fig. 1).

The embryonic development goes on rapidly, but depends considerably on the temperature of water, and hatching takes place within 30 to 65 hours. Some eggs hatched out while examining under microscope. The movements of tail ruptures the vitelline membrane, and the embryo appears like an egg with a whip like addendum at one end. Total length is 4·5 m.m., head with yolk sac being 2 m.m. and tail 2·5. The newly hatched larvæ lie on one side, and move their tails now and then, and when they swim they either rotate or spin round. The eyes are colourless, black pigment being confined to the lower portion of the yolk in a semicircular band (Fig. 2.). A few hours later yolk circulation becomes complicated and the caudal vein breaks up into branches, and is joined by the posterior cardinal vein near the bend of the yolk sac (Fig. 3). Blood in the latter vessel flows backward, so that the aortic and cardinal blood circulation is in the same direction. Eight hours after hatching the tail has elongated to 3 m.m. Pigment has appeared in the eyes. Yolk sac circulation forms a complicated system of cappilaries. An invagination, which later on forms anus, is seen in the tail region. Hinder extremity of notochord lies straight and there is amassing of tissue a little before its extremity forming the primordium of the caudal ray system. Heart beats 238 times in a minute. Ten hours later, dorsal aorta and caudal vessel have lengthened backwards, and in the anterior part of the caudal region, close to the posterior extremity of the yolk sac aorta gives off intersegmental vessels along the anterior face of myotome septa. These vessels run dorsally to form a pair of parietal vessels, which anteriorly fall back into the dorsal aorta just anterior to the auditory vesicle. At this stage pigment becomes scattered and appears in the form of stellate cells in the region of yolk.

Second day hatchings grow from 5·6 mm. to 6 mm. Head becomes distinctly marked off from the yolk sac, and an invagination for the future mouth appears antroventrally (Fig. 3). Eyes are profusely pigmented. Stellate pigmented cells spread round the notochord, multiply, extend to the anterior region of the head, and tend to make the animal opaque. Intersegmental vessels are seen in the head region as well, and their blood circulation is very irregular: in some it flows dorsally to the parietals and in others reversely without any definite alteration or arrangement. Pectoral fins appear as slight bud like out-growths, just behind the auditory vesicles. The posterior part of the embryonic fin shows fine striations.

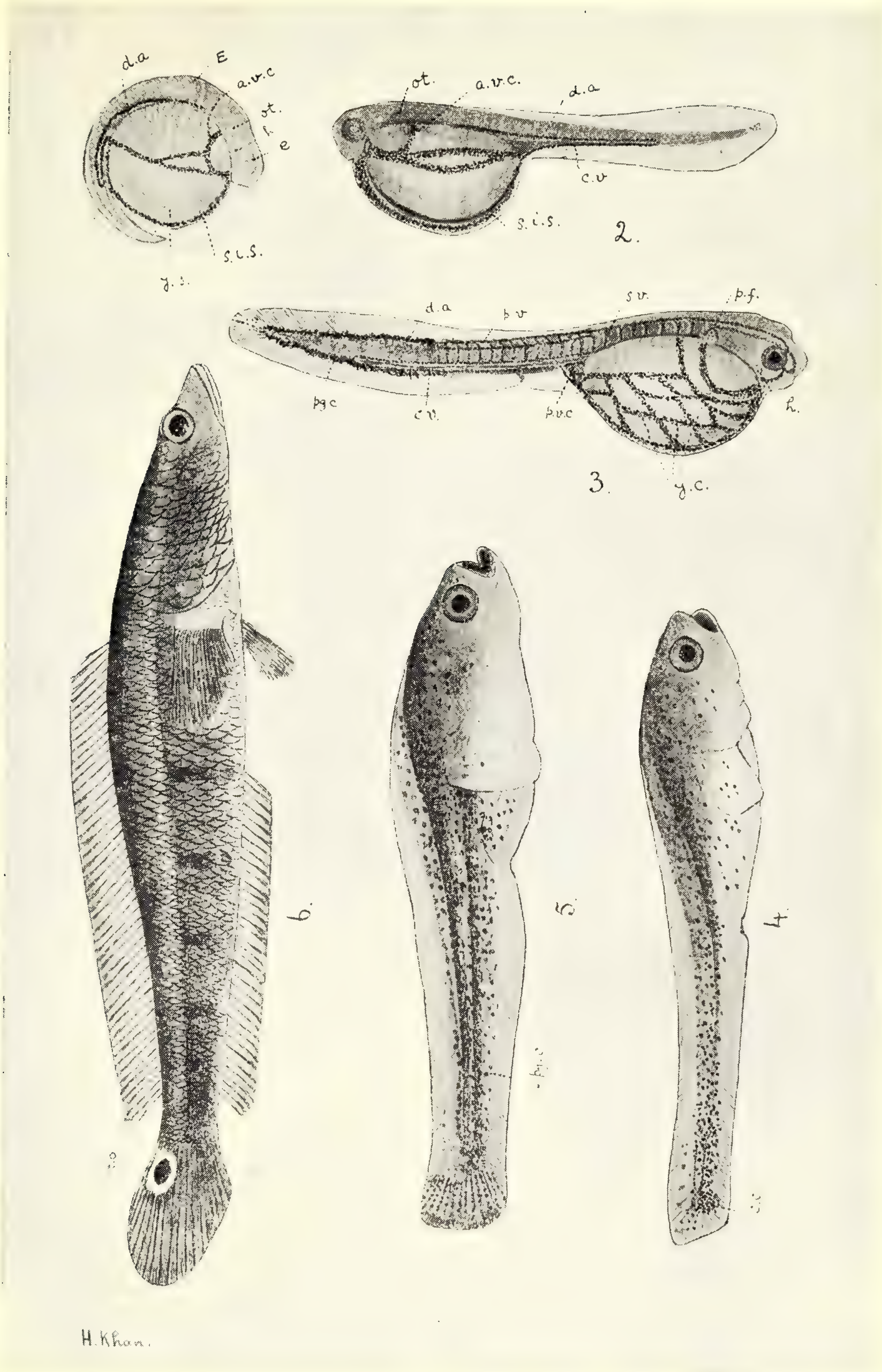
Third day animals measure 7 mm. mouth is open, and respiratory movements have begun. There are no external gills. Lower jaw is well developed, and shows regular rythmic movements. The head is thickened dorsoventrally. The pectoral fins are well developed, and help the animals in their rapid movements. They swim on the surface of water with yolk sac directed up, but when disturbed they go at once to the bottom and remain there for considerable time. Gut is visible as simple tube with muscular rectal walls, but not yet opened posteriorly. Yolk is reduced. Pigment cells are scattered throughout the whole body; and the dorsal and ventral embryonic fins are equally pigmented. Nostrils appear anterior to the eyes.

Next day larvæ measure 7 to 8 mm. Air sacs appear dorsal to the yolk bag, anteriorly, just behind the pectoral fins; and the animals now swim with the yolk sac directed downwards. Pigment cells have become rounded in many places, and lie more on the ventral surface than on the dorsal.

Fifth day shows no increase in length and the animals remain at the bottom for a long time. Spherical pigment cells are arranged in rows on the anterior extremity of the upper and lower jaws, where later on teeth are formed. Alimentary canal is convoluted and opens to the exterior posteriorly, while yolk disappears completely. Black pigment is now visible only in the ventral embryonic fin. Notochord is curved dorsally at its posterior end. Pectoral fins have enlarged and are striated, and have stellate pigment cells (Fig. 4).

Next two days neither show any increase in length nor any other remarkable change. It may be noted here that since the formation of ailmentary canal and the disappearance of yolk, the growth has not been uniform; but the rate of growth so far has been practically the same between the animals kept in live-car for observation and those in the pond with the parents. The total length in both cases is 8 mm.; head 3 mm.; tail 5 mm. The structure is also the same for the obvious reason that so far they have been getting their food supply mainly from the yolk.

On the eighth day the young ones in the pond, which so far have remained in one place, leave their nest and wander about along with their parents. It is now that a remarkable difference in growth occurs between animals in their natural environments and those kept in confinement. The animals kept in live-car, were fed on minced sheepliver, sieved through a piece of muslin cloth, or with liver-soup and sometimes with infusions of bacteria and mosquito larvæ. They were kept under the same environmental conditions as the fry in the pond, but still they did not show healthy growth. Further structural changes, formation of caudal rays and development of external form of body which took a week in the pond specimens, were completed in three weeks in those kept in captivity and their critical stage appeared with the formation of caudal rays, they became sickly, were attacked with fungus and died in large numbers.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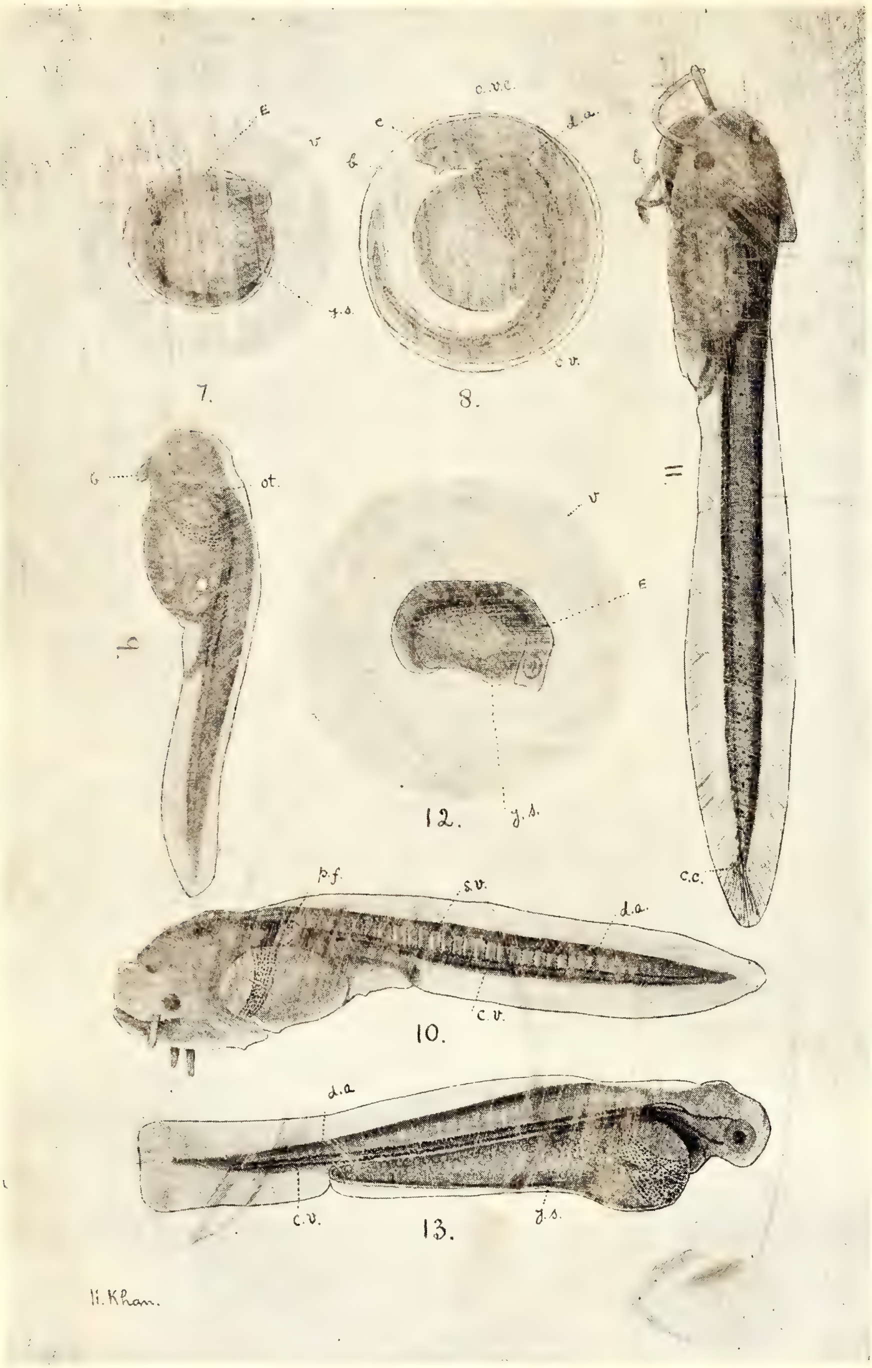
H. Khan.

Early stages in the development of some fresh water fishes in the Punjab.

(*For explanation see end of article.*)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H. Khan.

Early stages in the development of some fresh water fishes in the Punjab.

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On the eighth day circulation in the tail has reached the posterior extremity. The intersegmental vessels are present in the posterior region as well. The pigment cells are round, and are found in a group on the ventral surface of notochord near the posterior end ; and to this mass is given off from aorta a capillary vessel, which turns back and pours its blood in the caudal vein. This is the beginning of caudal capillary system which forms the basis of caudal circulation and marks the development of caudal rays. Next four days show the complication of capillaries, increase of pigment cells (Figs. 14, 15, 16, 17). Pigment cells become arranged in radial rows throughout the caudal fin and the blood vessels too, take the same direction.

Formation of caudal rays depends mainly on the healthy growth of the fry. In warm water, rays first appear on the 10th day, while in cold temperature the growth is retarded. Development of rays begin from the ventral surface and as notochord curves dorsally the rays are drawn towards dorsal surface.

The caudal rays appear as transparent yellowish white strips, in between the radially arranged pigment cells. The loops of blood vessels join together and combine into one. The vessel which carries blood to the ray flows beneath it while the afferent ones lie on its either side. Three basal pieces are also seen.

On the twelfth day (Fig. 5), eleven fully developed caudal rays are visible, segmented at their free ends and striated. Four basal cartilages can be distinctly traced. Caudal circulation is typical (Fig. 18). Just below the posterior end of notochord, the caudal artery branches, and each branch carries bloodtothe finary, and then turns back near the end of the fin, and pours its blood into another system of capillaries, which run on both sides of the fin rays and join to form the caudal vein. The length of body is 10 m.m. On the sixteenth day, caudal fin shows indication of separation from the embryonic fin. The animals have become very active. They come to the surface, exude small air bubbles and then go down and come up, thus causing small whirlpools, which make their presence visible from a distance. Some fry were kept in a dish: They at first came to the surface after 30 to 36 seconds, but later on their breathing became quicker and they were seen rising up after 10 to 20 seconds.

On the 17th day length varies from 15 to 20 mm. Caudal fin is separated off ventrally while dorsally it is still continuous. Eighteenth day marks the end of the larval period by the appearance of ventral or pelvic fins as rudimentary buds in the mid ventral line, a little behind the level of the pectoral fin. The caudal fin separates off completely from the embryonic fin. On the 21st day there are 16 caudal rays; and a yellow band runs dorsally and laterally from the eye to the end of the caudal fin, covering seven caudal fin rays. The fry hide at the bottom when approached, and remain under water for considerable length of time.

Rate of growth of the same lot and of the same year shows considerable difference, and is considerably affected by change in weather, temperature and other environmental conditions. Measurements for the last three years from the same locality do not correspond. For the first four or five weeks the difference in growth is remarkable. Some of the measurements for the last two years are given below:—

	1922.	1923.
1st Week.	8 mm.	8 mm.
2nd Week.	15 mm.	10 mm.
3rd Week.	27 mm.	14 mm.
4th Week.	42 mm.	24 mm.
5th Week.	51 mm.	42 mm.
6th Week.	58 mm.	58 mm.
7th Week.	....	63 mm.
8th Week.	74 mm.	67 mm.
11th Week.	90 mm.	80-83 mm.
12th Week.	98 mm.	99 mm.

Caudal ocellus near the proximal end of the caudal fin appears, in fry ranging from 70 to 90 mm., as a reddish yellow mark, in which later on black oval area becomes visible. Black area measures 1·5 × 2 mm. and yellow one 5 × 3 mm. At this stage fry has white ventral surface, dark grey dorsal and yellowish green sides with one deep yellow lateral band running from the eye to the end of the caudal fin just above the lateral line, and four distinct and two indistinct bluish green transverse bands, running across the body and over the dorsal surface, but interrupted at the lateral band (Fig. 6). Caudal fin is bluish black, pectoral yellow with blue tips, dorsal is dark, grey, while pelvic and anal are yellowish in colour. A few weeks later ventral surface becomes silvery white with slight bluish tinge, while dorsal is of dark greenish blue colour. The lateral band is deep bluish brown and loses itself in the dark back ground of the dorsal surface and becomes less perceptible. Below this band the colour of the body is light yellow mixed with blue and green. There are six to seven transverse bands of bluish green colour. Caudal fin is yellowish tinged with black, dorsal is dark grey and other fins are reddish yellow. The age of the fry at which ocellus appears varies from eight to eleven weeks.

Willey (17) gives his observations on *Ophiocephalus striatus* and S. Raj (15.) briefly describes the development of *O. punctatus* and *O. gachua*, but the life history of *O. marulius* has not yet been studied. Though it does not differ much from its allied species in its general outline, yet the short time taken to finish its larval development, is remarkable. A comparison is therefore made of the corresponding stages of *O. marulius* and *O. striatus.*

Ophiocephalus marulius.

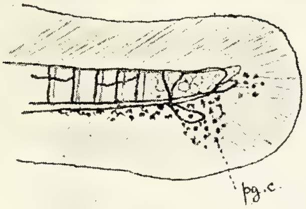
Days after hatching.	Total length.	Principal events.
1st	4·5-5 mm. ..	Yolk sac circulation at first simple becomes complicated. Black pigment cells appear and eyes at first colourless becomes pigmented. Invagination for future anus visible.
2nd	6 mm.	Stellate pigment cells appear. Mouth opens for respiratory movements. Pectoral fins arise. Posterior part of embryonic fin shows striations.
3rd	7 mm.	Pigment scattered equally. Gut visible as simple tube. Caudal vessels are drawn backwards.
4th	7-8 mm. ..	Air sacs formed and embryo swim with yolk bag directed downwards. Pigment cells spherical in some places and lie more on the ventral surface.
5th	7-8 mm. ..	Yolk completely disappears. Black pigment cells on ventral surface only, while dorsal is yellowish. Spherical pigment cells in rows on anterior extremity of jaws. Alimentary canal opens to the exterior posteriorly. Pectoral fin striated and has stellate pigment cells.

Days after hatching.	Total length.	Principal events.
6th	8 mm.	Dorsal aorta and caudal vein have reached the end of notochord.
8th	....	Amassing of pigment cells on ventral surface of caudal fin and beginning of caudal capillary circulation.
9th-11th	....	Arrangement of spherical pigment cells in radial rows, appearance of caudal fin rays and complication of capillary system. Posterior end of notochord is turned up.
12th	8 m.m.-10 mm.	Eleven caudal rays jointed and articulated with basal cartilages.
13th-17th	10-20 mm.	Caudal fin separated off ventrally and movements are very active and the fry rise to surface to take in air.
18th	15-20 mm.	Rudiments of ventral fins appear. Caudal fin is separated off completely from the dorsal and anal fins.
19th-21st	26 mm.	A yellow band runs on the dorsal surface and ventral one has bluish colour with black tinge.
	Ophiocephalus	*striatus* (Willey).
1	3·5 mm.	Yolk sac circulation established, pigment cells develop their black coloration ; pigment begins to appear in the eyes.
2 & 3	4·5-5 mm.	Pectoral fins arise, mouth opens and respiratory movements commence.
4	6·75 mm.	Larvæ leaving the surface and swimming freely at all levels. Bright yellow spots over eyes.
7	7 mm.	Larvæ swimming and turning in unison at the slightest concussion. Caudal cartilages appear.
12-15	6·75 mm.	Posterior end of notochord bends up.
28	8-10 mm.	Caudal rays jointed and articulated with the basal cartilages. Larvæ rise to surface to take air.

Days after hatching.	Total length.	Principal events.
37	10 mm.	Primordia of dorsal and anal rays.
40	10·25-13 mm.	Rudiments of ventral fins appear. Dorsal and anal fins separating from caudal.
63	17 mm.	
73	25 mm.	The fry hide in the mud.

In *Ophiocephalus striatus* " sixty-three days old fry are coloured a soft reddish brown or brown and pink, quite different from the black and yellow of *O. punctatus*. The general colour-effect is dominated by a broad lateral reddish orange band occupying almost the entire height of the myotomes, commencing from the eye on each side, and ending behind with a rounded edge at the base of the caudal fin concentric with the terminal contour of the latter. The iris is golden with a red flush ; there is a bright golden occipital point ; and the basis of the anal fin is dense black along its whole length. The colour of the fry is essentially that which it had acquired at half the size ; and it retains this colour until it has doubled the size, after which the definitive markings begin to appear. Instead of the reddish brown sub-translucent ground colour of *O. striatus* fry, *O. punctatus* fry are characterized by a blackish ground colour, upon which the bright golden yellow bands stand out clear, namely a pair of lateral bands about half the width of *O. striatus* fry bands, occupying the central third of the height of the myotomes and ending behind in a point extending about one-third of the length of the caudal fin into the substance of the fin. Along the length of the back is a golden yellow line running along the basis of the dorsal fin and presenting a more or less distinct interruption in the occipital region in front of the fin at the spot where there is a minute golden speculum in *O. striatus* fry. Besides all this, the *O. punctatus* fry present a clear yellow spot on the snout and do not possess the black basis of the anal fin." (16).

Fungus belonging to *Saprolegniaceæ*, attacks both the adult as well as the fry. It possesses a non-septate branched mycelium, multiplies asexually by club-shaped sporocysts, producing numerous bi-cilliate swarm spores, which emerge, move about in water and finally germinate in another place and produce a new individual of Saprolegnia. Huxley's (5) investigations show that the fungus settles on the portions of the skin of an apparently healthy fish, where there are no scales, and send mycelial or rhizoidal branches through the epidermis into the inner layers of the skin, causing at first local and then general disturbance of the system. Experiment by Rushton (14) on Rainbow trout supporting that of Patterson shows, that Saprolegnia is not the first cause but only a secondary one and only follows a bacillus or attacks on injured surface. In one of our fish tanks owing to the stoppage of water supply for over two months two fish out of thirty-seven survived in 1917. In December 1920 two big fish died in the same tank and they had patches of fungus growth on their body. Inspection of tank showed an overabundance of *spirogyra* and other Algal plants which were immediately removed and no death occurred in the adult fish after that. Fungus again appeared in July 1921 among fry kept in captivity in live-cars. In many cases the fry had their caudal portions discoloured with distinct filamentous outgrowths of Saprolegnia. The live-cars



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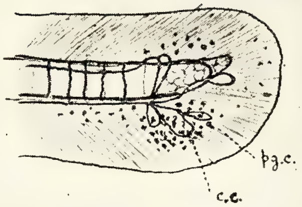

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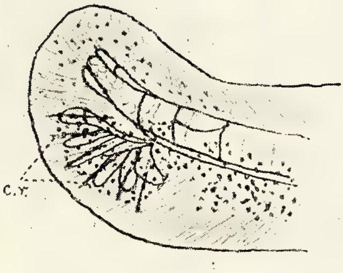

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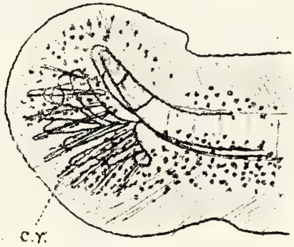

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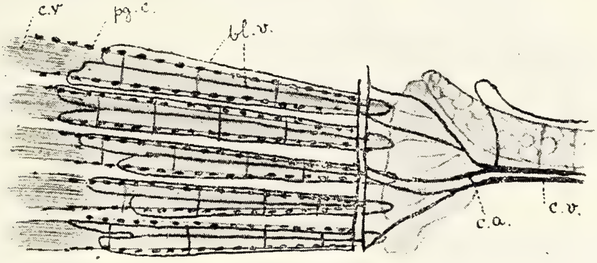
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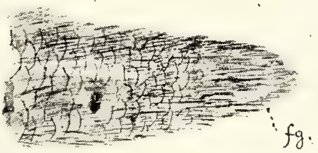

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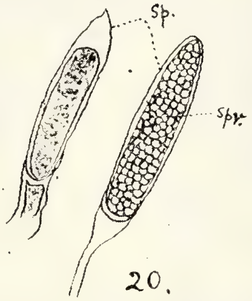

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H. Khan.

Early stages in the development of some fresh water fishes in the Punjab.
(*For explanation see end of article.*)

were then smeared with powdered salt, dried in the sun and washed in running water and fry put in there. These precautions reduced the death rate by 79 per cent. The following causes may, therefore, be assigned for its appearance :—

(1) Overabundance of Spirogyra and other algal plants.
(2) Injuries due to rough handling and overcrowding.
(3) Collection of food in the live-car.
(4) Incomplete aeration or stagnant water.

The treatment for fungus should commence as soon as it appears: if not it soon eats into the body and weakens the fish, making the cure more doubtful.

The growth of young fry with their parents is, as already remarked, far better than that of those kept in confinement in their earlier days. After six weeks the fry begin to scatter about, and it is then that they are taken from the tanks and kept in live-car and fed on minced goat's liver, goat's blood mixed with wheat flour or minced fish of common local variety. The growth of *Ophiocephalus marulius* is remarkably rapid and depends much upon the quantity and quality of food. Seventeen weeks' fry measure 118 m.m., from the tip of the snout to the end of the tail fin. Power of endurance possessed by *Ophiocephalidæ* is a well known fact and adult fish *O. marulius* have been carried long distances by road, while six months old fry have been carried by rail over 200 miles in ordinary tin carriers, and long distances by road for more than forty hours, with frequent change of fresh water and suitable food at regular intervals.

Of all the *Ophiocephalidæ, O. marulius, O. striatus* are the best sporting as well as edible fish—and most profitable from the point of breeding. The mature fish grow to more than three feet while other members do not attain more than one foot in length. *Ophiocephalidæ* are becoming very rare in the Province and are seldom seen in the market. They are considered a delicacy and fetch good price but their cannibalistic habits, as well as limited number of eggs, together with the fact that their fry are scattered during rains, which set in, soon after they have spawned and are lost and destroyed in large numbers in their wanderings, do not in any way tend to increase their numbers.

Culture of *Ophiocephalidæ* is not a difficult process as they are purely tank fish, and do not require any special environment for spawning. Fifteen hundred fry, three to four months old, were kept in two pits dug near a persian wheel well, supplied with fresh water from the well and fed on minced sheep liver twice a day. They were taken out after a month and were found to be in extremely good condition. It may therefore be said that any pond with fresh water will do for *Ophiocephalidæ.*

Cyprinidæ.

Early stages of *Labeo gonius, Cirrhina mirgala* and other members of the family differ much from the corresponding stages of *Ophiocephalidæ* and there is no mistaking of the two at any stage of their life. *Ophiocephalidæ,* moreover, spawn before the rains set in, while *Cyprinidæ* lay their eggs during the rains. In *Labeo gonius,* twelve hours after spawning, embryo is clearly differentiated with a pair of colourless eyes (Fig. 12). Heart appears a few hours later, as simple tubular structure giving off aorta and receiving vitelline veins. Newly hatched embryo, has a posteriorly drawn-out yolk bag with a band of black pigment. Blood circulation is that of typical Teleostean embryo. Eight hours after hatching pigment appears in the eye and intersegmental vessels are given off by aorta (Fig. 13).

Second day shows opening of the mouth and commencement of the respiratory movements. Pectoral fin appears as bud like structure. Blood circulation has become complicated, owing to the formation of aortic vessels to the external gills. From the ventral aorta are given off aortic arches, uniting to form the dorsal aorta, which gives off intersegmental vessels in its route and then turns back posteriorly to join the caudal vessel. Anterior and posterior cardinals are also present.

Yolk is absorbed on the 3rd day. Air sacs are visible. Stellate pigment cells are scattered over the body. Pectoral fins are well developed and help the fry to move about in the little pools, in which they have been left by their parents, in search of food. Caudal vessels are drawn to the extreme end. On the fourth day, the notochord is bent dorsally, and caudal capillary system is formed. In two days the vessels take on radial direction, and rays begin to appear on the 6th day. On the 9th and 10th days there is well defined curve of the notochord with 18 caudal rays and typical caudal circulation. Length varies 7 to 8 mm. Alimentary canal is simple tubular structure. Black pigment cells are rounded on the head, while stellate on the body and intestine. Ventral surface is silvery and caudal fin is slightly forked.

Stages in the development of caudal fin illustrate the fact, that homocercal tail of the adult is secondarily derived. Fin rays appear on the ventral side. The region where they are present soon forms a lobe ; and an externally heterocercal tail is produced. Dorsal embryonic lobe is without fin rays and contains the notochord. The ventral lobe continues to develop ; and soon projects beyond the dorsal, which gradually atrophies and finally disappears, and the ventral lobe forms the permanent tail fin, which, though internally asymmetrical, assumes an externally symmetrical form.

On the eleventh day the length is 9 mm. Dorsal fin is becoming marked off from the embryonic fin. On the sixteenth day six rays are seen in the dorsal fin which is now separated off completely from the caudal fin. Body is opaque owing to pigment cells. Dorsal surface is of dark colour, while ventral is brilliant white mixed with yellow and blue tinge. Iris is bright scarlet with yellow around and black pigment dorsally. On the seventeenth day, length has increased to 10 mm., and caudal fin becomes constricted off ventrally as well. from the embryonic fin. One row of scales is visible dorsally as tile like coverings. Twenty days old fry are bluish silvery white in colour on the ventral surface ; greenish blue with purple in visceral region and reddish in the head. Caudal fin is completely separated off on the 21st day and more scales appear.

A great deal yet remains to be done in connection with the study of developmental stages of *Cyprindæ.* To this group belongs a vast number of edible and sporting fishes and their culture should be the main object of a Pisciculturist. They yield far larger number of eggs than any other fresh water group of Fishes.

Siluridæ.

Wallago attu embryos differ from those of *Labeo gonius* and *Cirrhina mirgala* in possessing a round yolk sac like that of *Ophiocephalidæ* (Fig. 7). Embryo differentiates in less than twelve hours and hatches out in twenty-four hours (Figs. 8, 9). Newly hatched out embryo shows two pairs of lobular projections at the antro-ventral end of the head : these grow to form the barbels. On the second day pectoral fins appear ; and mouth opens for respiratory movements, (Fig. 10). Pigment cells are scattered. Gut lies dorsal to yolk sac, which is much reduced. Eyes are pigmented. Head is broad and flattened. External gills are present. Caudal circulation has reached the posterior extremity. Intersegmental arteries are also developed from dorsal aorta. Third day shows the formation of capillary vessels in the caudal portion (Fig. 11). Gut opens to the exterior. The embryos are very active. Their mouths are wide, and tails long. They attack each other and catching their fellow from its thinner posterior portion, whirl it to and fro, break it into two and devour it.

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(17) Willey, A. .. .. .. "Spolia Zeylanica". Vol. VI, Pt. XXIII, Dec. 1909.

Explanation of the Plates.

av.c.=anerior vena cava ; *b*=barbel ; *bl. v.* blood vessel ; *c.a.* = caudal artery ; *c.c.* caudal capillary ; *c.v.*=caudal vein ; *c.r.*=caudal ray ; *d.a.*=dorsal aorta ; E=embryo ; *e*=eye ; *fg*=fungus filament ; *h*=heart ; *o.t.*=auditory sac ; *p. f.*=pectoral fin ; *pg.c.*=pigment cells ; *p.v.*=parietal vessel ; *p.v.c.*= posterior vena cava ; *s.i.s.*=subintestinal vessel ; *Sp.*=sporocyst of *Saprolegnia* ; *Spr.*=Spores ; *s.v.*=intersegmental vessel ; *t.o.*=tail ocellus ; *v.*=vitelline membrane ; *y.c.*=yolk capillaries ; *y.s.*=yolk sac.

Ophiocephalus marulius.

Fig. 1 : Egg with Embryo fully developed, two hours before hatching.
Fig. 2 : Newly hatched Embryo.
Fig. 3 : Second day Embryo (after hatching).
Fig. 4 : Fifth day Embryo.
Fig. 5 : Twelfth day Embryo.
Fig. 6 : Fourteen weeks old fry, with caudal ocellus.

Figs. 14, 15, 16 and 17 show development of caudal capillaries and formation of caudal rays in the tail fin of *O. marulius.*

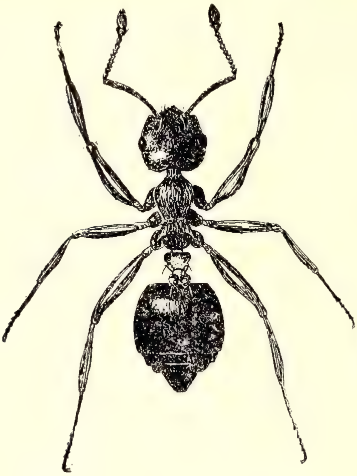
Fig. 18 shows caudal circulation.
Fig. 19 : caudal portion with fungus growth.
Fig. 20 : Sporocysts of *Saprolegnia* with spores.

Wallago attu.

Fig. 7 : Egg with Embryo, twelve hours stage
Fig. 8 : Egg with Embryo fully developed.
Fig. 9 : Newly hatched Embryo.
Fig. 10 : Second day Embryo.
Fig. 11 : Third day Embryo.

Labeo gonius.

Fig. 12 : Twelve hours stage.
Fig. 13 : Newly hatched Embryo.



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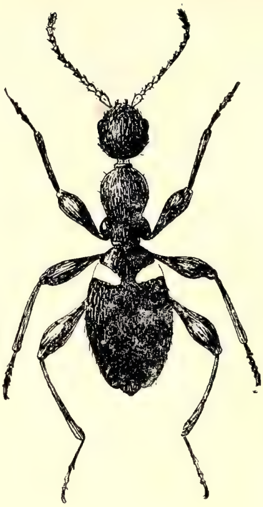

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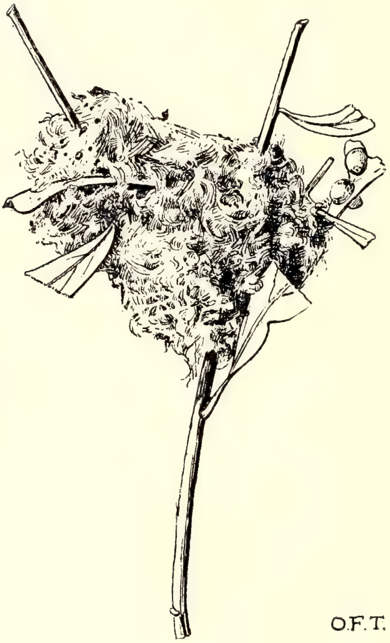

3.

The Cremastogaster Ant.

1. *Cremastogaster auberti*. X 10.
2. Beetle (*Formicomus ninus*) that mimics ant. X 10.
3. Byre of Cremastogaster Ant, composed of seeds. Natural size.

THE CREMASTOGASTER ANT.

BY

MAJOR R. W. G. HINGSTON, I.M.S.

(With a plate.)

Common Ants of Baghdad—Characters of Cremastogaster—Its nest—Food supply—Treatment of dead and wounded—Erection of abdomen—Pastoral activities—Architecture of byres—Care of cattle—Instinct of communication—Olfactory sense—Judgment of workers—A beetle mimic.

The observer at the fringe of the Baghdad oasis cannot fail to find his notice soon directed to the varied kinds of ants. The most prominent are those which inhabit the soil. There is *Messor,* the harvester, a maker of roads. It loves to establish itself near some cultivated field where it fashions a smooth and conspicuous thoroughfare between the harvesting area and the granaries in the nest. This thoroughfare is the highway for the movements of the ants along which they incessantly pass to and fro. We see them first exploring the field of harvest, then converging with their burdens to the extremity of the path, then advancing steadfastly along the road until they disappear through the entrance of the nest. None can fail to notice these industrious streams, so constant in purpose, so determined in effort, so free from all obstruction or confusion, so striking an example of well organised labour in which each is fulfilling its share in the toil.

In the vicinity we are sure to find another kind of ant. This is the large and formidable *Myrmecocystus,* which digs deep galleries into the bare sand, selecting if available some sloping bank. The workers are very different from the peaceful harvesters, their character being that of the rapacious hunter, active, swift, individually powerful, and capable of overwhelming all kinds of insects which they drag as provender into the nest. In their movements they are not confined to special roads, but they scour the sand in all directions, each worker securing its individual capture by virtue of its own activity and strength. At the nest we will observe the more remarkable of their performances, such as their skill in evacuating large piles of sand, their manner of ejecting dead insect shells, their wonderful method of conducting a migration by which one worker seizes hold of a comrade and transports it bodily to the new home.

The habits of these species I have elsewhere discussed*. For new material we must turn to more secluded haunts. In the shady gardens we will meet with another kind, one smaller and less conspicuous than the inhabitants of the sand, a species that keeps almost exclusively to the vegetation and known to science as *Cremastogaster auberti* (var. *sorokini*).

It is not likely to attract immediate attention, being peaceful in its habits, methodical in its behaviour, and neither like *Messor* going in search of seeds, nor like *Myrmecocystus* pursuing prey. It indulges rather in the tranquil occupation of a quiet pastoral life. Its length does not exceed one-seventh of an inch, though it is of moderately sturdy build. In front is the somewhat square-shaped head with minute black eyes and club-like antennæ. Behind this comes the thorax raised into an arch and furnished with two projecting spines. A slender nodulated waist connects this with the abdomen, of which the noticeable feature is the triangular shape with the base in front where it joins the waist and terminating in a sharp apex behind. There is some variety in its pattern of colour, the head and thorax being a reddish brown, the abdomen a glossy black. Its body is altogether naked save for a trace of fine silky hairs. (*See Plate*).

The nest is constructed in the hollow of a tree, often in some crumbling cavity of the trunk, or, if near the ground, in a decomposing root. Occasionally they may occupy a crevice in the soil or the tubular cavity of a dead hollow stick. In

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* In " A Naturalist in Himalaya."

India I have seen an allied kind choose the thorns of an acacia and empty the pith from a stalk of elephant grass in order to establish a suitable nest. The broken end of a branch is a favoured situation. There the exposed wood soon passes to decay. It becomes soft, is easily tunnelled, and falls to the attack of boring beetles which perforate the decomposing stump. The ants take advantage of the beetles' excavations and appropriate the tunnels for their own use.

The entrance to the nest is but a mere slit, quite unlikely to attract attention and with little or no excavated debris outside. The interior is hollowed into smooth chambers which communicate with one another by narrow galleries and contain the usual larvæ and eggs. Males and females also will be found in the passages, and, of course, a number of the worker caste. From the gateway proceeds a steady line of ants, some ascending, others descending, up and down the trunk of the tree. As excavators they show no conspicuous talent, never heaping up piles of ejected debris after the manner of the vigorous inhabitants of the soil.

They gain most of their sustenance through pastoral activities, attending on different kinds of bugs which supply them with a limpid juice. Much also is obtained by just biting at the foliage or at the young unopened buds. Certain leaves have little glands which emit fluid, and this excretion is acceptable to the ants. They will carry off small particles of animal matter. The minutest insects too will be taken to the nest, some of which are probably captured alive. But, like many ants, it is fluid that they really seek, and will accept either animal or vegetable juice. They will suck up the liquid from a disembowelled insect, or encircle a drop of syrup in peaceful contentment, all crowding round the delicious nectar in a greedy motionless ring.

These ants are partial to many kinds of trees, being commonly found on the poplar and mulberry, less often on the pomegranate and palm. The cultivated fig is a particular favourite, since its leaves are often crowded with the liquid-giving cattle and its timber honeycombed by insect pests. The ants are thus supplied with their two requirements, a profusion of food distributed through the foliage and nesting places dug into the branches and trunk. A species of *Capparis* also attracts them, its beautiful white flowers and purple tipped stamens being one of the chief adornments of this soil. They are constantly licking at its stems and leaves, though they come to it mainly for the buds and fruit. Indeed every part of this thorny shrub appears capable of supplying something to the ants. At the buds they chew the soft external coat and reach the vegetable tissue direct. The fruit supplies them with a richer provender. It opens widely so as to expose the seeds which are sunk in a sweet gelatinous fluid coloured a bright red. Round this viscid material the ants collect, often a large number at one open fruit all eagerly sipping at the juice.

Their peaceful character is evident in their treatment of the dead and wounded. Most ants, when they meet with an injured comrade, are thrown into the greatest flurry and excitement, often dashing at it with wide-open jaws, attacking it with the same intensity and vigour as if it were an enemy rather than a friend. They often treat it after the manner of cannibals. The *Myrmecocystus*, for example, after first lynching it, drags it for provender into the gate. The *Œcophylla* employs it to a simlar purpose, the workers coming round it in a murderous ring and literally stretching it to death. They treat their dead with the same disrespect and bring them to the formicary for use as food. It is otherwise in the case of the peaceful *Cremastogaster*. I place some dead and injured comrades near the nest. There is no display of violent hostility, no indication of any serious alarm. After a little while the workers take up their dead, carry them quietly to some distance from the formicary where they lodge them in a retired nook amidst the leaves. Thus these ants make some decent disposal of their dead which to other kinds are of value solely as food.

It is a well-known habit of the *Cremastogaster* ants that they erect their abdomens at right angles to their bodies when they happen to be alarmed. In this little species the behaviour was not conspicuous. At times, when closely pressed, it would certainly do so, but never in that persistent angry manner which we observe in some of the larger kinds. In a previous book I have made mention of this special habit, and suggested that its purpose was to serve as a balance during the ascent and descent of a tree. But I now feel sure that this explanation is incorrect. The behaviour is part of a defensive plan. At the tip of the abdomen is a fragile sting, so minute as to be invisible without the help of a lens and suitable only for delicate work. It cannot, for example, pierce the skin of the hand, but, in other parts, such as the neck, where the integument is thin, the spear can give a sharp prick. A reservoir of poison communicates with the weapon, and the fluid may be seen exuding from its tip in the form of a watery drop. When the *Cremastogaster* meets with an insect enemy, as I have observed in the larger kinds on Indian trees, it immediately erects the triangular abdomen and emits the venomous juice. The attacker, which may for instance be a *Prenolepis* ant, knows clearly the meaning of this abdominal erection. It hurriedly withdraws from the danger signal and thus escapes any injurious effect. The elevation of the abdomen is a warning act, part of the defensive scheme of operations associated with the possession of poison and sting.

Such strategy can be of use against only the smallest enemies. It could scarcely serve as a protection from birds. But birds, as a rule, are not partial to ants. They probably dislike the formic acid taste. The woodpecker, however, is a formidable enemy. Though in Mesopotamia it is extremely rare, yet in wooded districts no other bird feeds so habitually on *Cremastogaster* ants. Moreover, the ants seem aware of their enemy, at least the larger species on Indian trees instinctively adopt a method of escape. With the edge of my killing-bottle I have sometimes struck the tree immediately below a *Cremastogaster* ant. It was a sharp and sudden tap such as a woodpecker makes on the bark when hammering with its chisel beak. And often when I did so the ant stood still, fixed itself motionless close against the bark. No doubt it imagined that its enemy had arrived, and instinctively felt that the immobile attitude supplied the best chance of its being passed unseen.

These ants, as I have said, are of a pastoral disposition, depending in the main on other insects which, like cattle, supply them with a valuable juice. In this connection the aphids are of great importance. The workers go in search of them all over the tree. They find numbers on both the stems and leaves of the poplar, but the place of selection seems to be the stalk close to its junction with the leaf. In their search they employ the plan of circumnavigation, especially when investigating the smaller leaves. This is a methodical system of examination, the ant running round the edge of one leaf before passing on to explore the next. It is a good example of their orderly activities as a result of which the whole mass of the foliage is surveyed.

When they find a group of aphids they pay it close attention. The workers collect around it in a cluster, not displaying any emotion or excitement, but just quietly attending the herd. Their antennæ may be seen in continuous motion, since these organs are made to stroke the bodies of the aphids as if to induce them to render forth their juice. At intervals we will observe the emission to take place. Each. little aphid hoists up its abdomen, squeezes out from the tip a drop of limpid fluid which the ant that is stroking it immediately devours. All over the tree we may detect these little parties, each a quiet pastoral association in which the ants are the herdsmen and the aphids the herds.

This poplar aphid is very minute, to the naked eye little more than a speck. The members of the herd are usually wingless, being for the most part young and immature forms. At this stage they are somewhat fusiform in shape. The head end is blunt, supplied with eyes and antennæ, while the hind extremity is distinctly pointed and prolonged into a kind of tail. Its structure is so delicate as to be almost transparent, and its general colour is a pale green with a tinge of brown upon the head. At the tail extremity is the tiny pore through which the excretion is emitted to the ants. Here and there in the clusters we meet with an adult, a little insect of graceful and delicate structure with a dark body and white lacy wings. It receives the same attention from the herdsmen as is given to the undeveloped forms. Its association with the herd is only temporary. Hitherto it has been a mere reservoir of liquid, a stationary apparatus for the withdrawal of sap. But now it has developed gauzy wings ; its reproductive instinct claims attention, and it flies off to find another resting place where it becomes the parent of a new group.

The strength of a commune of *Cremastogaster* ants will depend in the main on the numbers of these herds. A tree covered with cattle will maintain a multitude, while one that bears a few scattered groups can support only an impoverished nest. These aphids withdraw a great quantity of sap and must often do considerable injury to the trees. This is particularly the case with the apricot. They infest the tree in immense numbers, so much so that the fluid falls from them like rain and coats the verdure in a sticky juice. Other insects then come to reap the harvest, especially the hornets and certain species of wasps which eagerly drink the sweet honey-dew.

The special preference which *Cremastogaster* gives to the fig is due, like the poplar, to the cattle on its leaves. Almost every fig tree in these shady gardens maintains its quiet procession of ants. The herd is, however, different from that on the poplar. It is composed of a cluster of scale insects or coccids, another of the heterogeneous group of bugs. This little insect is oval in shape, soft and delicate, looking almost structureless except for the fact that its margin is sinuous and its body divided into rings. It is hidden from view in a kind of fluffy material, the product of its cast-off skins. These accumulate around it so as to form a white coat which makes it look like a flake of snow.

The coccids usually occupy the base of a leaf. They also align themselves along the midrib, wrap themselves around the green stalk or assemble on the stem of the fruit. Often they collect in a dense cluster with their edges overlapping like a heap of coins and buried in their discarded skins. Both old and young are represented in the herd. The foliage around them often glistens as if with varnish. This is due to the viscid secretion of the coccids having escaped and then dried into an inspissated layer. The ants attend these cattle in the same way as they do the aphids, standing around them like patient herdsmen and titillating persistently with their attennary threads.

These ants, like certain other kinds that tend on cattle, construct special habitations for the shelter of the herd. But the byres of the *Cremastogaster* are neither very common nor are they built in that wonderfully elaborate manner such as is displayed by the *Polyrhachis* ants. I found one of their sheds in the fork of a pomegranate tree. It was a triangular shaped edifice wedged into the cleft and somewhat less than an inch in length. Its structure was composed of delicate material, an assortment of fine particles of vegetable tissue built into a compact wall. Inhabiting this tabernacle was a pair of coccids, a meagre collection for so elaborate a shed. Yet even so few were of great value to the ants ; otherwise they would never have expended the labour of enclosing them in a firm wall. The reason is, of course, that their value is continuous. Day and night they give forth their droplets of fluid which is probably sufficient for a number of the ants.

I found another exquisite type of chamber fashioned exclusively from downy seeds. There is a profusion of such material at the end of the summer, the trees being in places so laden with fluff as to appear under a fleece of snow. Some is shed from the seeds of the poplar ; more from the smaller plants. The byre composed of it was on the trunk of a poplar tree. It was oval in shape, about the size of a walnut, smooth in the interior, but on the outside rough so as to look like a fluffy ball. Though delicate in structure, it was closely interwoven, the downy plumes being so knit together as to form an unbroken wall. At one extremity was a small gateway, the only opening into the cavity of the cell. It was merely a slit of the narrowest dimensions and just sufficient to permit the entrance of the ants. Some stems of the poplar passed through the interior round which the aphids were closely packed like cattle stabled within a shed. The whole habitation was delightfully snug, as soft and cosy as if composed of wool, and a most efficient protection for both the cattle and the ants. (See plate).

A neat pattern of byre is occasionally met with fashioned out of a poplar leaf. The leaf has been folded longitudinally so that the lateral edges come together and the midrib marks the line of the fold. The edges are observed to be connected with silk which results in the formation of a leafy tube. The open ends of the tube must then be secured, and the ants effect this by constructing a wall. From below they carry up minute particles of debris which they build into a barrier at the ends of the tube. Near one edge of the barrier they leave a narrow slit, just wide enough to give them entrance into the tunnel, and, since a similar slit is made at both extremities, they are provided with two opposing gates. The resulting habitation is about an inch in length. It is shaped in the form of a flat triangle with a fissure-like cavity enclosed all round. Within, of course, is the accustomed herd feeding on the tissue of the leaf.

The folded structure of this leafy habitation reminds us of the architecture of the red ant. This latter species habitually nests in the foliage, drawing a number of leaves together and uniting their edges with a layer of silk. Sometimes, however, it employs a single leaf, bending it transversely so as to bring the apex to the base and then connecting the margins all round. This habitation of the *Cremastogaster* is, therefore, somewhat similar. A single leaf is taken and bent upon itself. It differs in that the fold is longitudinal instead of transverse, but more essentially in the fact that the *Cremastogaster* uses debris for the purpose of closing the ends of the tube. The red ant has no notion of such building operations. It is most expert at folding and approximating leaves and at weaving quantities of delicate silk, but it knows nothing of the art of accumuladebris tingor of the building of such material into a wall. When a gap exists in the nest of the red ant, the only method of securing the opening is by closing it with layers of silk.

But we must be careful not to overestimate the skill of the *Cremastogaster*. The tunnel, thus fashioned, is a complex piece of work, its edges being linked with threads of silk, its extremities closed with walls. It seems as if this ant combines two separate instincts, the erection of debris and the elaboration of silk. But this, I think, would be a false conclusion. It is greatly to be doubted if the occupying ants were responsible for the silken portion of this byre. I have never seen them employed in the manufacture of such material, though other kinds, of course, produce it in abundance, employing their larvæ for the generation of the threads. In this instance it seems more probable that a species of spider was responsible for the silken portion of the byre. The ants found the habitation partially constructed, its edges in apposition and connected with threads. They took the spider's industry to their own use, strengthened the chamber, added walls to its extremities, and thus by a combination of robbery and workmanship fashioned an excellent byre.

An idea can be gained of their mode of architecture when a breach is made in the wall of a byre. A few workers come out to attend to the damage and allocate to themselves the business of repair. They pull the little fragments back into place, piling them up and so adjusting them as to restore the broken part of the wall. I see no special mechanism for holding them together, nothing analogous to the interlacing of threads such as other ants employ to bind the bricks. The architecture of the *Cremastogaster* is more primitive and simple. The bricks just naturally adhere to one another through the intertangling of loose shreds of tissue or the interlacing of plumed seeds.

On neighbouring trees we will find another type of byre-builder. This is a species of *Polyrhachis*, a larger, more powerful and more expert ant. It is partial to a different kind of vegetation, frequently choosing the orange and the peach. As an architect it is far more elaborate than the *Cremastogaster* since it spreads long tunnels over the trunks and branches,constructing them of debris interwoven with silk. The *Cremastogaster* can claim none of such remarkable efficiency ; it superimposes and to some extent interlaces its fragments, working more like a bird at the building of its nest.

These works of construction are sufficient to indicate that the ants take great care of their valuable herds. Some workers remain continually with them, since those cattle, which have involved the ants in such labour, must on no account be left to themselves. Here is an example of their watchful care. I cut away a byre and thus expose the herd which had been enclosed probably for many weeks. But the workers in the vicinity soon came to the rescue and gave attention to their precious charge. Each took up an aphid in its jaws, some managed to get hold of two or three, and they quickly conveyed the exposed cattle to the shelter of the main nest.

Although these ants do not combine for the purpose of aggression, nor join their forces for the shifting of loads, nevertheless they possess that instinct of communication by which one ant can call out its comrades from the nest. In most ants the instinct is for the purpose of attack or in order to rescue a captured prey, but it has for the *Cremastogaster* the more peaceful use of bringing others to a discovered herd. Its manner of operation is according to principle, being conducted after the plan of the *Phidole* or the *Camponotus* which has been elsewhere described. Nevertheless there are certain details of interest which deserve a few brief notes. In order to see the operation I give a dead grasshopper to an ant. The wanderer is attracted to this rich morsel, immediately attaches itself, then bites at the integument, but soon, realizing the immensity of the discovery, runs down the branch in the direction of the nest. If it happens to meet a comrade the information is communicated. We observe the manner in which their antennæ meet. It is not just the usual passing touch such as occurs when the ants move ordinarily about. This is a more prolonged and agitated titillation, and has the effect of transferring to the second ant the enthusiasm possessed by the first. Then they separate and move in opposite directions, the discoverer descending to the main nest, the other ascending to where the treasure lies. We follow the discoverer down to the gate. Almost immediately on its entrance the workers issue forth. They do not emerge in any special formation. It is not a multitude like the legion of the *Phidole* nor a compact troop as in the *Camponotus* ants. The party of the *Cremastogaster* is a straggling line, each worker separately emerging from the gateway and independently ascending the branch. The discoverer does not lead them. On the contrary they are despatched and the ant that has brought the news may not emerge until many of the party have been sent on their course. Thus the instinct in *Cremastogaster* has reached considerable perfection in that the issuing column can reach the treasure without further help from the discovering ant.

The interrupted file ascends the tree, hastily, enthusiastically, in a long procession, and obviously aware of the good things in store. Reaching the grasshopper, each ant takes a grip of it ; more and more follow and join in the combination until very soon the discovered insect is enveloped in a black mass of ants. The behaviour that follows is somewhat different from that of other species.

The *Phidole* army, for instance, falls violently on its victim, the troop of the *Camponotus* tears it limb from limb. Here, however, we observe a more quiet assemblage. The workers gather round it in great numbers. They bite at the integument, suck the exposed flesh, sometimes pile themselves thickly over it and encircle it in a dense ring. But there is no display of hostility or anger. Each worker merely tries to get a fragment for itself. This is in accordance with *Cremastogaster* habits. These ants are conspicuously individual in character ; each one is in the habit of waiting separately on cattle and independently taking its share. Thus when they come forth to this rich discovery, they cannot, like other ants, combine to make use of it, but each pursues an individual course. It is for this reason that the issuing party is so straggling. The *Phidole* must advance in a multitudinous body in order to overwhelm and subdue the prey. The *Camponotus* for the same reason must join in a compact troop. But for this ant such immediate combination is unnecessary ; hence the workers can emerge in a broken file.

As the *Cremastogaster* does not combine for the subjection of a victim, so also it cannot join to transport the mass. The *Phidole* or the *Camponotus* would have quickly moved it and transferred it bodily to the safety of the nest. But the *Cremastogaster* workers simply heap themselves about it. Each tries to break away a little fragment or to fill its belly with a droplet of the juice. But never do they make the slightest effort to shift it. They lack completely that instinct of combined transportation, and just feed on the carcass till it is an empty shell.

The reason is that under ordinary circumstances the *Cremastogaster* ant summons forth its comrades because it has happened to find a new herd. Their combination is peaceful, while in other ants it is aggressive. For their pastoral operations the art of capture is unnecessary, nor is the instinct of transportation required. It is easy to observe how they call assistance to the cattle. To a vigorous community I give a fresh herd. The ants had spent the season with aphids on the poplar, so I supply them with coccids on the leaf of a fig. The strange herd and foliage did not in the slightest disconcert them. The first worker that discovered them realized their value, but made no attempt to keep the treasure to itself. On the contrary it hurried down to the nest, distributed the news of the new fountain above, and very soon the snow-white heap of coccids was enveloped in a crowd of ants. Thus the workers in their discoveries show no greed for themselves. Their object is to tell of each fresh addition so that all may partake of the liquid store.

I have discussed in connection with other kinds of ants the mechanism by which this communication is performed. It has been shown that the discoverer, on returning to the nest, lays out behind itself a line of scent, and that the ants after emergence reach the treasure by following back along the scented track. There can be little doubt about their sense of smell. I place a nodule of camphor across their path. They are immediately disturbed by it and are reluctant to touch it. They come close up with the object of examining it, but quickly withdraw from the unpleasant odour and make a détour in order to get round. It is not that they are affected by the sight of the camphor, for other white objects are touched without hesitation when similarly placed so as to obstruct their line. Like other kinds of ants that move in files, they recognise their road by this faculty of smell. Anything that disturbs the scent confuses them and checks the ordered progress of their march.

But we are here considering the mechanism of communication, so I will mention an experiment connected with the act to show how precise is the olfactory sense. A long straight branch ascends from a nest and divides some distance higher up into three subsidiary stems. At the tip of one stem I give an insect to a worker. Very soon it establishes a line of comrades which moves first up the main branch, then out along the special stem. While this is in progress I do the same on a second stem. The second ant hurries back with the news, and, on reaching the main ascending branch, runs direct into the file that the first ant called forth. It communicates with them, evidently tries to turn them, but the workers, though obviously excited by its touch, yet refuse to deviate from the correct path. They move out along the stem of the first experiment, that is the one to which they were primarily despatched. The second ant can gain no assistance from those despatched by the first ant ; it must complete the journey to the nest in order to send forth a party for itself. The fact is that the ants will not be confused when confronted with two diverging lines of scent. Certainly they show some little hesitation on reaching the point where the main branch divides. A few may move an inch or two in the wrong direction, many waver before choosing the correct stem. The diverging attractions obviously perplex them ; but this, we will notice, is little more than momentary, and all in the end take the right course. The ants will thus stick to the line of scent which the discoverer supplies them at the gate of the nest. Though other discoverers may meet them on the journey and though they may be agitated by this further information, nevertheless they keep to the primary impulse and maintain the line of the original scent. I repeat the operation on the third stem. In this way another discoverer is started, which on its descent to the main branch comes in contact with a pair of streams. Again I observe the same result. These streams will not be turned from their original directions. The third discoverer must descend all the way to the nest before it can collect its own party and despatch them to its individual find.

Thus, in this way, three streams pour forth from the nest. While on the main branch they all unite, and the ants ascend in a common flow. But where the stems diverge the stream breaks into tributaries, each tributary representing that particular portion despatched by the separate ants. How wonderfully efficient is the faculty of smell which results in such precision and accuracy of movement when confronted with diverging streams.

Another interesting point about the act of communication is that the instinct of the ants seems tempered with judgment in that the number of the workers called forth to the discovery is proportionate to the bulk of the find. Some of the first arrivals, after a preliminary investigation, make their way back again to the nest in order to summon still more to the scene. But they do not act imprudently, nor waste their numbers ; sufficient only for the purpose are despatched. An experiment will indicate this resourcefulness of operation, I cut a grasshopper into three unequal portions. The first is one-fifth of an inch in length ; the second is twice the bulk of the first, and the third twice the bulk of the second. I give these three pieces to separate workers on different parts of the same tree. Each discoverer, of course, brings back the news, and in a few minutes three streams of ants are ascending to the pieces of flesh. I give them plenty of time to continue the operation, not meddling with them for forty minutes, by which time the business must be absolutely complete. I then count the ants at the different pieces. Twenty-eight have been despatched to the smallest fragment, forty-four to the one of intermediate size, and eighty-nine to the largest piece. These numbers, it will be noticed, are roughly double of one another, which is the same proportion that exists between the bulk of the fragments supplied.

This same relationship may be observed to exist wherever the ants attend to their herds. A few aphids will have with them only two or three workers, while a large and vigorous cluster may attract twenty or more. One might imagine that all would crowd to the spot whenever a store of precious food was found. But they do not adopt such indiscriminate action ; they are possessed of a better and more frugal organization, and will not unnecessarily waste their strength. There seems to be some element of judgment in the act. If they sent forth the numbers for the purpose of capture or to carry off a burden, as in the case of the

Phidole, then it would be easier to understand the behaviour. It would merely be a case of the accumulation of reinforcements until sufficient had arrived either to quell the struggles or to cause the burden to move. The accomplishment of the purpose for which the ants were summoned would be the sign that sufficient had arrived. But these ants, as we have seen, do not combine for such an object. They all appear to act individually, each carrying off its own morsel to the nest. It would, therefore, seem that they are able to exert some little judgment, and to realize just how many are sufficient to deal with each source of supply.

In our observations of the habits of this *Cremastogaster* species we are sure to meet with a little beetle which forms an interesting association with the ants. It is not of the kind that visits the nest, but one that joins in the outdoor activities of the workers, especially in their domestic operations on the trees. It is most likely to be found on a bush of poplar, particularly one where crowds of ants are industriously tending their herds. If we are to find it we must search with considerable care, since it bears a very remarkable resemblance to one of the ordinary ants. It is in fact an excellent mimic, fashioned and clothed in such a manner that it can scarcely be distinguished in the midst of its friends.

This beetle is *Formicomus ninus* of Laferte and belongs to the family *Anthicidae*. (See plate).

Let us place it side by side with a worker ant and observe the resemblance between the two. In size and conformation they show very little difference. The beetle's head, though smaller than that of its model, resembles it in general shape. It has similar black spots to serve as eyes, and the antennæ are superficially like those of the ant. Behind it has the same kind of constricted neck, an ant-like thorax raised into an arch ; a fair attempt has been made at the triangular abdomen by means of the pair of close fitting shards which are given that characteristic shape. But the most interesting feature is to be found in the coloration. The general scheme bears a perfect resemblance, the reddish brown of the head and thorax, with the glistening black of the triangular abdomen, being identical with that of the ant. The beetle, however, has something additional of which its model does not show a trace. There is on the back of its wing-covers, just behind the waist, two patches of white, one on either side. Each of these spots is oval in shape ; it extends to the outer edge of the wing-cover but does not quite reach in to the middle line. Thus this part of the beetle presents the following appearance. On either side there is a light-coloured area, and between the two a line of black connecting the triangulated wing-covers with the chest.

An examination of the ant will explain the reason. It possesses a remarkably constricted waist, in fact the thorax is linked to the abdomen by little more than a mere thread. There is nothing of the kind in the conformation of the beetle, since it is the natural characteristic of this Order to have a broad, or at least, a moderately broad waist. Here, therefore, we observe a marked defect in the close resemblance between the beetle and the ant. In the one the waist is a broad hinge ; in the other a slender thread. But the plan of colouration just described has for its object the restoration of this defect. Its purpose is to produce a false impression by giving the beetle the appearance of a waist. The two white patches on the sides of the wingcovers do not appear as if part of the beetle. They contrast so markedly with the surrounding black that their appearance is that of a deficiency in structure, as if a notch had been cut out of either side. The black line between them seems to be the true connection, and thus thorax and abdomen appear linked together by a slender artificial waist. Nature has thus wonderfully clothed the beetle, even to so minute a detail in its conformation, in order to make perfect its resemblance to the ant. Its bodily structure cannot be sufficiently altered, hence recourse has been had to a method of deception through the production of a false effect.

This little beetle, so remarkably adapted, wanders about on the stems and leaves. It lives in the open, seeking no concealment, and moves freely in the midst of the ants. Its accustomed haunts are identical with theirs, the cattle-laden foliage being the place of selection, though it also descends to explore the bark or investigate the debris underneath the tree. All its actions are peculiarly antlike. It has their rapid mode of ordinary progression, its legs working and antennæ trembling in their characteristic agitated way. Also, when engaged in searching the vegetation, it is in the habit of working round the edges of the leaves after the same methodical manner as the ants. Thus not only in structure, but in habits and behaviour there is a marked resemblance between the two.

The beetle seems to live a vegetarian existence, frequenting the poplar for the sake of its sap, as is also the purpose of the *Cremastogaster* ants. The beetle, however, receives the liquid direct, while the ants obtain it through the intermediation of the herd. In its wanderings we will frequently observe it to halt and commence to lick at the surface of the leaf. It may remain for a long time biting at the foliage as though able to get out the sap. These halts frequently take place near the base of a leaf, at which point there is a pair of minute papillae that seem to attract the beetles to the spot. These are little glands which secrete a fluid that supplies the beetles with their most abundant food. The mimics and the ants live in perfect harmony. I never see a sign of hostility or friction. Though both compete for the precious fluid, yet they work together in rural peacefulness, the one existing on the products of the vegetation, the other, it may be said, domesticating a herd. The beetle is thus solely an outdoor visitor, a companion of the ants in their pastoral life.

We have here an excellent example of mimicry, since the beetle, as a consequence of its close resemblance, is lost to all but the most observant eye. There can be little doubt that the purpose of the mimicry is to supply the beetle with a garment of defence. These worker ants live a life of comparative immunity. Had they many enemies, they could not work with such freedom on the foliage, tending their herds in these conspicuous heaps. They are supplied with a sting and a reservoir of acid which must be sufficient to keep enemies off. But the little mimic, on the other hand, is altogether unprotected, having no weapons, nor poison, nor any knowledge of attack. Its search after sap must take it into the foliage where it will be fully exposed to view. Numerous dangers will there confront it, and, in all likelihood, it would cease to exist unless supplied with some suitable defence. It has, therefore, assumed the appearance of a worker, and, by living in the midst of the busy commune, is mistaken for one of the well-protected ants.

In this study of the habits of the *Cremastogaster* we have not met with anything of very striking originality, though we have observed a combination of organized methods different from that of any other kind of ant. The points of interest are the peaceful character of the workers and their peculiar love for certain types of vegetation because of the rich liquid food. Their pastoral activities take most of their attention, and they expend much labour in the erection of byres, though they have not arrived at the most perfect type. They are efficient enough in conveying information, in despatching their comrades to new supplies of provender, and are wonderfully skilful in following a path by means of their sense of smell. They are totally deficient in the capacity for transportation, at least beyond the carrying of an individual load. On the other hand they show some judgment in the distribution of their forces, despatching sufficient, and no more than sufficient, to deal with each source of supply. Lastly we have observed their companionship with a beetle which they effectually but unconsciously protect.

SOME NEW ALPINE GRASSHOPPERS OF THE GENUS *CONOPHYMA* ZUB. FROM CENTRAL ASIA.*

By

B. P. Uvarov, F.E.S.

Sub-family—Catantopinæ.

Conophyma zubovskyi, sp. n.

Closely allied to *C. semenovi*, Zub.

♂. Larger than any known species of the genus. *Antennæ* longer than the head and pronotum together. *Head* moderately reclinate. Frontal ridge slightly convex in profile, narrowed at the fastigium, practically parallel-sided elsewhere, obliterate about half-way between the ocellum and clypeus, sulcate in the middle, punctured between antennæ. Face with coarse, but sparse, punctures and rugulose. Cheeks coarsely punctured and rugose. Vertex moderately sloping, longer than broad, scarcely convex and coarsely punctured in front, smooth and practically flat behind; median carinula irregular and low, but well distinct; lateral margins punctured, very obtuse, carinated only behind. *Pronotum* cylindrical, thick; its disc very coarsely, though not deeply, punctured and rugulose; distinctly convex; first transverse sulcus irregular, nearly obliterated, not cutting the keels; second sulcus well developed, broadly bi-sinuate, cutting all three keels; third sulcus straight, cutting deeply all three keels; median keel low, thick, irregular, partly obliterated by the rugosities of the disc, more especially so at the front margin and in metazona; lateral keels distinct only in front of the second sulcus, practically obliterate behind it, slightly convergent backwards and feebly concave between the front margin and the second sulcus, slightly divergent behind it; prozona 2½ times as long as metazona; hind margin slightly roundly excised. Lateral lobes gibbose between the sulci, concave in the lower hind portion, coarsely rugose. *Mesonotum* somewhat longer than one half of metazona, coarsely punctured and rugose except at small irregular spaces on its sides at the anterior margin; median keel very low, subobliterate. *Metanotum*, not quite twice as long as metazona of pronotum, coarsely punctured and rugose, except at fairly large semi-oval spaces at the sides; hind margin straight; median keel low, thick. *Abdomen* with the first tergite slightly longer than metazona, coarsely punctured and rugose; the following tergites also punctured, but the coarseness and depth of punctures decrease gradually; median keel developed throughout the abdomen, although low. Last tergite with two large lobes, shaped as equilateral triangles, their distance from each other being less than the basal width of one lobe. *Supraanal plate* transverse, trapezoidal, slightly widened behind, with two triangular, rounded apically teeth, placed close to the lateral margins near their middle and connected by a fine transverse suture; the surface impressed, more deeply so near the hind angles which are rounded, incrassate and very finely punctured and rugulose; median sulcus distinct in the basal half, with its margins convex distally obliterate; hind margin scarcely bi-sinuate, with a short, broadly triangular median lobe. *Cerci* strongly compressed, slightly incurved, projecting well beyond the supra-anal plate, rounded apically.

The types of new species described in this paper are in the Zoological Museum of the Russian Academy of Sciences, Petrograd; some para-types are in the British Museum (Natural History) and in the collection of the Turkestan Entomological Station, Tash-Kent.

*The present paper is a supplement to Mr. Uvarov's previous paper on the *Acrididae* of C. Asia published on page 260 of this volume.

Coloration blackish-olivaceous, shining. Lateral lobes of pronotum testaceous-yellow below, blackened above. Abdomen with testaceous submedian spots at the anterior margins of the tergites 3-6. Supra-anal plate nearly black. Hind femora brownish, without any pattern; the knees blackish. Hind tibiæ pale olivaceous-yellow.

♀ (paratype). Only the third sulcus cutting the median keel of pronotum. Median keel sharp and distinct throughout pronotum and abdomen. Lower valvae of ovipositor minutely serrulate, without teeth. Coloration olivaceous-green; no submedian spots on the abdominal tergites.

	♂ (type.)	♀ (paratype).
Length of body	21 mm.	27 mm.
,, pronotum	5	6
,, hind femur	12	13

Described after 4 ♂ ♂ and 2 ♀ ♀ from Ladyar-Tau, distr. Osh, province Ferghana, 20, vi, 1913; and 1 ♂ from the Alai mountains, Ferghana, in Prof. R. Ebner's collection.

The female of this species is extremely alike a female of *C. semenovi*, differing from it only in the somewhat larger size and in more roughly punctured and rugose body, but the structure of the male genitalia, and particularly of the supra-anal plate is very peculiar in the new species. It is obvious, however, that the plate of *C. zubovskyi* represents no entirely new features not observed in *C. semenovi*, but may be regarded as a further stage of specialization. Indeed, the remarkable sublateral teeth on the plate of *C. zubovskyi* may have developed out of low gibbosities observable in *C. semenovi* and connected in that species also by a transverse suture (not mentioned in the original description, because it is not always distinct). The new species is also well separated from *C. semenovi* geographically.

It gives me a great pleasure to be able to dedicate this remarkable species to the author of the genus, the well-known Russian orthopterist Mr. N. N. Zubovsky whose unfortunately not numerous papers on *Acrididæ* of Siberia and Central Asia represent a standard of clearness and fulness in systematic work.

Conophyma mitchelli, Uv.

This species has been described by me (Ent. Mon. Mag., 3rd Ser. vii, p. 269) after a single female from Srinagar, Kashmir, about 12,000 feet, and a fresh lot of insects collected by Mr. F. J. Mitchell in the Kashmir between 11-13,000 feet and sent by the Bombay Natural History Society to the Imperial Bureau of Entomology includes another female and the undescribed male, which gives me an opportunity of describing it here, as follows:

♂. Smaller than the female and much more slender. Antennæ a little shorter than the head and pronotum together. Face strongly reclinate. Frontal ridge sulcate throughout. Fastigium of vertex narrow and long, with the lateral carinæ well developed, but without the median carinula; temporal foveolæ as in the female. Eyes about as high as the subocular distance (in the female distinctly less than that). Pronotum more elongated than in the female, and more rugose; transverse sulci well developed; metazona equal to one half of the prozona; the median keel developed throughout; lateral keels in the first section of the prozona distinct, though somewhat irregular, almost straight, somewhat convergent backwards; between the sulci and in the metazona they are very irregular, gradually divergent. The two oval impressions on the upper part of the lateral lobes are marginated from below by thick folds (which are present in the female also, but no so well developed and regular). Hind margin of the pronotum obtusely excised, with the margins convex. Mesonotum, metanotum and abdomen as in female. Last tergite with two rounded triangular teeth, about as broad as they are long and separated from each other by an interspace distinctly broader than one of the teeth. Supra-anal plate scarcely longer than it is broad, slightly narrowed behind, with the hind angles broadly rounded ; hind margin with a triangular median projection, which is shorter than it is wide at the base. Cerci conical, slightly incurved, projecting beyond the anal plate, but their actual length is not more than that of the plate. Subgenital plate obtusely conical recurved.

Coloration of the male (as well as that of the female in the collection studied) is somewhat different from the type. Male is blackish-brown from above, and in both sexes the angulated black fascia on the lateral pronotal lobes is well in contrast with the brick-red (brighter in the female) of their front margin and of the hind lower portion. In both sexes the sides of the abdomen are black, but all these differences from the type cannot be regarded as important.

Measurements of the male are, as follows : length of body 15 mm. ; pronotum 3·25 mm. ; metanotum 1·5 mm. ; hind femur 8·5 mm.

The discovery of the male of *C. mitchelli* enables me to state definitely that my doubts as to the species belonging really to the genus *Conophyma* are not justified. This is a true member of the genus, although very distinct from other known ones by the strongly rugose body. The zoo-geographical value of this conclusion is in the fact that all other species of *Conophyma* are known from the high mountains of the Russian Turkestan, and *C. mitchelli* appears to be the most southern representative of the genus which gives an evidence of a close relationship between the alpine faunas of all the great mountain ranges of Central Asia. It makes it also highly probable that other species of *Conophyma* will be discovered in Himalayas.

Conophyma miramæ, sp. n.

Similar to *C. sokolowi*, Zub., but belonging to the group of *C. semenovi*, Zub. in the structure of male genitalia. ♂. Size under medium for the genus. *Antennæ* in the type broken. *Head* moderately reclinate. Frontal ridge somewhat convex in profile, gradually widened downwards, more strongly so below the ocellum, obliterate near clypeus, shallowly sulcate throughout except in the dilated lower portion. Vertex sloping, nearly twice as long as broad, narrowed anteriorly, slightly impressed behind, without the median carinula and with the lateral carinulæ well distinct between the eyes but obliterated in front. *Pronotum* short; its disc practically flat, feebly bi-concave and with faintly indicated large punctures near the lateral keels in front of the first sulcus, indistinctly rugulose in metazona, bearing four pairs of very low, scarcely perceptible, smooth tubercles arranged as follows : the first pair close to the front margin of disc, equidistant from the median and the lateral keels, second pair in front of the first sulcus and the third pair between that and the second sulcus, nearer to the median keel than to lateral ones ; the fourth pair of elongate tubercles between the second and third sulcus, nearer to the lateral keels than to the median one and each of the tubercles enclosed between two shallow impressions. Transverse sulci all cutting lateral keels ; first one shallow, nearly obsolete, straight ; second sulcus well developed except near the median keel where it is obsolete and does not cut the keel ; third sulcus well developed throughout, cutting all keels, broadly rounded-angulate in the middle. Median keel obliterate close to the front margin, well raised and convex in profile in the rest of prozona, quite distinct in metazona. Lateral keels well developed, callous throughout except between the first and the second sulci where they are obliterate, straight and slightly convergent backwards in front of the first sulcus, very slightly concave and divergent behind the second sulcus. Prozona two and a half times as long as metazona ; the latter very obtusely excised behind. Lateral lobes deeper than long, not strongly gibbose between the sulci, smooth, with large, nearly obliterate punctures in the lower third, more distinctly rugulose in metazona. *Mesonotum* subequal in length to metazona, with the median keel replaced by an indistinct smooth line and without the lateral keels. *Metanotum* not twice as long as metazona; its disc distinctly bi-concave, with practically obliterate punctures near the lateral keels; median keel obtuse, tectiform; lateral keels obliterate near the front margin thick and callous in the rest, convergent backwards, incurved at both ends. First tergite of the *abdomen* slightly longer than metazona of pronotum; its disc tectiform, strongly bi-concave laterally and with large punctures especially near the lateral keels; median keel well raised; lateral keels very thick, callous, scarcely convergent, but distinctly incurved apically, behind; sides of the tergite rugulose. The following tergites with some scattered punctures and a lateral line of foveolæ, adjoining the lateral keels, which are low, but perceptible on the second and third tergites and obliterate in the rest; median keel is also lowered and obliterate from the third tergite backwards. *Last tergite* with two small triangular submedian lobes, separated by the width of one lobe. *Supra-anal plate* trapezoidal, distinctly narrowed apically, shorter than broad at the base surface concave at the sides of the median ridge which is moderately raised, thick, sulcate in the distal half; close to the each lateral margin there is an acute, rounded apically, flattened tooth, directed backwards, but slightly projecting sideways; hind margin sinuate on each side of the median lobe which is broadly triangular, short, with the apical angle about 90° and pointed; hind angles of the plate slightly projecting, rounded. *Cerci* strongly compressed laterally, somewhat incurved, with the apex rounded. *Subgenital plate* obtuse.

Coloration above brownish and black, with yellowish and testaceous pattern. Pronotum dull blackish-brown along the middle, with broad and indefinite testaceous fasciæ; lateral lobes ivory-white below, shining black, turning brownish above, in the rest. Mesonotum, metanotum and abdomen black, dull on the meso and metanotum and the first tergite, shining in the rest, with broad testaceous fasciæ along the lateral keels; an indefinite pale testaceous median fascia begins from the third tergite, becoming broader, paler and more distinct backwards. Pleuræ shining black with an oblique, callous, ivory-white stripe. Hind femora testaceous, without definite fasciæ. Hind tibiæ pale sanguineous.

	♂ (type).
Length of body	12 mm.
„ pronotum	3
„ hind femur	7

Described after a single male from the range Alexandrovsky, distr. Aulie-Ata, 23, vi, 1920.

This is an extremely well-marked species, easily recognisable by the peculiar sculpture of pronotum, metanotum and of the first tergite, but especially by its genitalia, reminding those of *C. zubovskyi*, m.

The species is named after Miss Emilia Miram, assistant in the Orthoptera room of the Petrograd Zoological Museum and author of several valuable papers on Russian Orthoptera.

Conophyma jacobsoni, sp.n.

Related to *C. sokolowi*, Zub., but larger.

♂. *Antennæ* distinctly longer than head and pronotum together. *Head* reclinate. Frontal ridge slightly convex in profile, shallowly sulcate throughout, gradually and feebly widened below the ocellum, obliterate near clypeus. Vertex strongly sloping, about half again as long as broad, slightly narrowed anteriorly, scarcely concave, punctured in the fastigium, with a feeble median carinula and low, disappearing in front, lateral carinulæ. *Pronotum* elongate, slightly widened behind; disc obtusely tectiform, shallowly and indistinctly punctured and callously rugulose, more distinctly so in metazona; first sulcus completely obsolete; second distinct, but not deep; third fairly broad, but not deep, cutting the median keel; median keel sharp, in profile convex, in the metazona low, but distinct; lateral keels well distinct throughout the prozona, slightly convergent from the anterior margin towards the second sulcus, but distinctly bent outwards just before it, feebly divergent behind it; metazona shorter than one-half of prozona; lateral lobes, slightly longer than deep, feebly gibbulose between the sulci, smooth, with but few minute punctures, more distinctly punctured in metazona. Mesonotum scarcely longer than the metazona of pronotum; median keel very feeble; lateral keels distinct only at the very hind margin, low, slightly more approached to each other than the keels of pronotum. Metanotum not twice as long as metazona, obtusely tectiform, its disc slightly concave laterally, with shallow and broad punctures and indistinct callous rugosities; median keel quite distinct, tectiform, not sharp; lateral keels callous, obtuse, obliterate at the anterior margin; lateral lobes with a large, shallow, oblique impression, punctured behind it. *First tergite* obtusely tectiform, its disc somewhat concave laterally, punctured and rugulose as the metanotum; median keel tectiform, low; lateral keels callous, thick, distinctly displaced outwards from the keels of metanotum, convergent backwards. Second tergite with very feeble median and lateral keels, the following tergites without keels. *Last tergite* with two triangular lobes, which are about as long as broad and separated by an interspace half again as broad as one of the lobes. *Supra-anal plate* trapezoidal, slightly broader than it is long; hind angles obtuse and rounded, hind margin slightly convex, with the median lobe short, rounded, occupying about one-third of the width of hind margin; median ridge broad, convex, scarcely narrowed posteriorly, slightly sulcate at the base. *Cerci* compressed, elongate-triangular in profile, rugulose, extending a little beyond the plate.

Coloration above shining-black with ivory-white pattern, below and on the legs pale yellowish-testaceous. Head dull-black above, with faint, narrow testaceous postocular fasciæ. Pronotum with the lateral ivory-white fasciæ moderately wide; lateral lobes shining black above, ivory-white below. Mesonotum brownish black, with the fasciæ developed in its hind half only, slightly more approached to each other than those of the pronotum, emitting forwards very faint, not callous, pale stripes converging to the metazona. Metanotum with the fasciæ as broad as on pronotum. Pleuræ black, with an oblique ivory-white fascia. Abdomen with the median line (except on the first tergite) and two continuous fasciæ ivory-white. Hind femora without any trace of fasciæ. Hind tibiæ red throughout.

♀ (paratype). Pronotum, metanotum and first tergite distinctly rugosely punctured, with the keels low, not callous, but distinct. Head above and discs of pronotum, mesonotum, metanotum and of first tergite pale greenish-grey, with brown, grey and blackish punctures. The rest of abdomen above castaneous, with the fasciæ testaceous. Bands on the lateral lobes of pronotum, pleuræ and on the side of abdomen, black. Lower valvæ of ovipositor with strong, but short teeth.

	♂ (type)	♀ (paratype)
Length of body	16 mm.	23 mm.
,, pronotum	3·75	4·25
,, hind femur	8	9

Described from 5 ♂ ♂ (including the type) and 4 ♀ ♀ from Tchimgan, distr. Tashkent, 21, vi—2, vii, 1920; 1 ♂ and 3 ♀ ♀ from Ak-Tash, distr. Tashkent, 23, vii, 1920; 1 ♂ and 1 ♀ from Tchervak, distr. Andizhan, 16, vi, 1913.

The series before me shows very little variation in the coloration of males in which the fasciæ are sometimes pale sulphur-yellow, sometimes testaceous; females vary more widely, the black fasciæ on the sides of body tending to disappear. Some females are practically unicolorous brownish, without distinct fasciæ. The shape of the male supra-anal plate is also not quite constant, sometimes being nearly quadrate, but with the hind angles always rounded, hind margin convex and the apical lobe broad, which separates the species from *C. sokolowi*, apart from the different sculpture of pronotum, differently shaped lateral keels of the latter and coloration. Especially noticeable are the unbanded hind femora.

According to Mr. Plotnikov's communication, the species is quite common and numerous in the mountains at Tchimgan, near Tashkent.

I dedicate this species to Mr. G. G. Jacobson, of the Zoological Museum of the Academy of Sciences, Petrograd, the compiler of the best existing work on Palæarctic Orthoptera ‡ which stimulated greatly the interest of Russian entomologists in this group of insects and educated several orthopterists, myself included.

Conophyma plotnikovi, sp. n.

Apparently near to *C. simile*, Zub.

♂. Small. *Antennæ* slightly longer than head and pronotum together. *Head* reclinate. Frontal ridge slightly convex in profile, distinctly sulcate, narrowed at the ocellum, widened and obliterate near clypeus. Vertex sloping, concave, without median carinula, with feeble, convergent forwards lateral carinulæ. *Pronotum* short and broad, cylindrical, scarcely widened behind, its disc slightly convex, but very distinctly gibbulose with shallow round impressions and callous tubercles between the sulci, punctured at the anterior margin, and very coarsely punctured and rugulose in metazona ; sulci deep, but only the third one cutting the median keel ; median keel thick, smooth, slightly convex in profile, distinctly lowered near the anterior end, distinct in metazona ; lateral keels thick and low, but distinct in front of the first sulcus, subparallel for a short space at the front margin, then strongly convergent towards the first sulcus, behind which they are practically obliterate, very irregular and very strongly divergent towards the second sulcus, displaced sideways and quite irregular behind the latter, obliterate in metazona ; metazona shorter than one half of prozona, rotundate-truncate behind; lateral lobes about as long as deep, strongly gibbose in the upper half of prozona, densely punctured and rugulose in metazona. *Mesonotum* slightly longer than metazona of pronotum, with fine median keel behind, without lateral keels, with elongate shallow impressions on the sides. *Metanotum* not twice as long as metazona of pronotum, very obtusely tectiform, with the disc slightly concave on each side of the median keel, which is well distinct, but not sharp ; lateral keels distinct in its hind two-thirds only, low, callous, irregular; two shallow oval impressions near the lower hind angles (just above the pleural suture). Pleuræ with shallow, broad impressions. *Abdomen* with the three keels on the first tergite only ; this tergite shallowly concave on the disc, on each side from the median keel. Last tergite with two widely distant triangular lobes, which are longer than at the base broad. *Supra-anal plate* quadrangular, slightly broader than long, with lateral margins feebly concave ; apical margin feebly convex, with a small emargination in the middle, where a short, narrow lobe is projecting; hind angles practically straight, somewhat attenuate (owing to concavity of lateral margins); surface raised along the middle in shape of a low ridge, narrowed posteriorly (where it forms the median lobe), sulcate in the basal half, distinctly separated by oblique sulci from the slightly incrassate lateral margins and from the oval convexities placed at the hind angles. *Cerci* short, compressed, elongate triangular in profile.

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‡ Orthoptera and Pseudoneuroptera of the Russian Empire (In Russian), Petersburg, 1916.—The Oothoptera part of the book has been done by G. G. Jacobson, that on Pseudoneuroptera by V. L. Bianchi. The work has been based on Tumpel's book, but only modesty of the authors caused them to undertone that, as The contents and scope of their book required an enormous amount of original work.

Coloration pale buff below, shining black and blackish-castaneous with buff pattern, above. Head above testaceous-brown, marmorated indistinctly with brown. Pronotum with the disc black along the middle, turning castaneous on the median keel and in metazona, with two buff fasciæ, moderately broad and strongly convergent backwards in front of the first sulcus, suddenly dilated and displaced outwardly behind it, gradually narrowed and divergent backwards ; lateral lobes with the upper half shining black. Mesonotum testaceous brown, with four large round blackish spots across its anterior half, separated with testaceous-buff color. Metanotum with the disc blackish-brown, fading into testaceous behind ; a little more than anterior half of the median keel, triangular spots narrowed backwards on the lateral keels, and short streaks above the pleural sutures, buff. Pleuræ black in a little more than upper half only. First abdominal tergite blackish-testaceous on the disc, fading into testaceous behind, with the median keel buff in more than anterior half, with broad, narrowed posteriorly irregular buff spots on the lateral keels ; the rest of abdomen with a broad pale-buff median fascia, and a lateral row of elongate irregular buff spots. Hind femora with the faintest traces of testaceous fasciæ above. Hind tibiæ very pale sanguineous in the apical half.

♀(paratype). Reddish-ochraceous, dull, with some black, or blackish marks distributed, as follows : a small indefinite spot in the middle of prozona, four spots across the mesonotum, middle parts of discs of metanotum and first tergite, large lateral spots on the second tergite with pale centres, a double submedian row of small spots on the other tergites, hind femora with a small basal spot, a black dot on the upper carina before the knee and two fasciæ in the upper areas extended also half-way down the inner and outer surface. Front and middle legs in small blackish spots; lower valvæ of ovipositor with strong teeth.

	♂(type)	♀(paratype)
Length of body	14 mm.	18mm.
,, pronotum	2·5	3
,, hind femur	7·5	8

2 ♂ ♂ and 3 ♀ ♀ from the summit of the Malyi Tchimgan, distr. Tashkent, 10, vii, 1920 ; 1 ♀ and 1 ♀ from the pass Pessotchny, Tchimgan, distr. Tashkent, 16, vii, 1920.

This species is represented by two very distinct color forms, one marked strikingly in black and buff, as described for the male type, another is protectively colored in reddish-ochraceous with obsolete brown and blackish marks (see description of the female paratype) ; to the latter belong 1 ♂ and 2 ♀ ♀ from the Lesser Tchimgan. As there are no structural differences between the two forms, I have no doubt that they are con-specific and represent only either individual variations, or, more likely, are connected with different kinds of environment ; in the latter case they may be distinguished as two *morphæ* of the species, but direct observations on the spot are necessary to verify this conclusion.

C. plotnikovi differs from *C. simile*, Zub., in the structure of pronotum, in coloration and in the shape of the male supra-anal plate.

The species is named after my friend Mr. V. I. Plotnikov, Director of the Turkestan Entomological Station, who has done much to advance our knowledge of the insect fauna of Turkestan.

Conophyma pylnovi, sp. n.

Resembling *C. plotnikovi* m. in the structure of pronotum, but differing from it strongly by the male genitalia.

♂. *Antennæ* longer than head and pronotum together. *Head* not strongly reclinate. Frontal ridge slightly convex in profile, distinctly widened between the antennæ, feebly sulcate, not reaching the clypeus. Vertex strongly sloping, about half again as long as broad, flat, median carinula slightly perceptible at the very apex, no lateral carinulæ. *Pronotum* very short and thick; its disc practically flat, even slightly concave before the first sulcus and between the second and third sulci, dull, but not rugulose or punctured in prozona, distinctly rugulose in metazona; all sulci deep; the first sulcus straight, cutting the lateral keels deeply, but not the median keel; second slightly sinuate, cutting the lateral keels, and very nearly cutting the median keel; third deep, obtusely angulate, cutting all three keels; median keel in profile slightly convex, distinctly lowered at the second sulcus and interrupted by the third, low, thick, in metazona quite low and irregular; lateral keels before the first sulcus quite distinct, slightly convex, strongly convergent backwards, low, thick and irregular farther backwards, distinctly divergent between the first and second sulcus, less so between the second and third sulcus, hardly perceptible in metazona; lateral lobes slightly deeper than long, strongly gibbose in their upper parts, with the broad foveolæ adjoining the lateral keels marginated below by distinctly raised ridges, the surface obsoletely punctured, and rugullose except in metazona which is coarsely punctured. *Mezonotum* somewhat longer than metazona of pronotum, smooth, with faintly indicated median keel, but without the lateral keels. *Metanotum* not quite twice as long as metazona, very obtusely tectiform, bi-impressed; median keel very low; lateral keels thick and low, not developed in the anterior third. *First tergite* as long as mesonotum, tectiform, bi-impressed, with the median keel thick, but well raised; lateral keels thick, slightly convergent backwards. The following tergites with only a smooth median line instead of the keel, without lateral keels. *Last tergite* with two small, rounded lobes, slightly longer than they are broad, separated from each by an interspace half again as broad as one of the lobes. *Supraanal plate* trapezoidal, slightly longer than broad, with the hind angles rounded; hind margin slightly convex on each side of the median lobe which is short, triangular, not broader than one-fourth of the hind margin; surface practically flat impressed at the hind angles, with the median ridge scarcely raised, feebly sulcate basally and more distinctly so at the apex. *Cerci* compressed, reaching to the apex of the median lobe, strongly narrowed apically.

Coloration dull blackish-brown, variegated with brown and brownish-festaceous above, testaceous below. Pronotum without fasciæ on the disc; lateral lobes blackish-brown above, shining black in the rest, except the hind angles which are reddish-brown. Mesonotum, metanotum and first tergite dull blackish-brown above. Pleuræ shining black. Abdomen shining blackish-brown, with an indefinite median fascia and very irregular, interrupted lateral testaceous fasciæ with blackish dots. Hind femora with scarcely distinct dark fasciæ; sanguineous below. Hind tibiæ sanguineous.

♀ (paratype). Sulci of pronotum not deep, but distinct and all of them cutting the lateral keels. Coloration dark reddish-brown, dull, densely dotted with black, without definite fasciæ. Hind femora more distinctly fasciated than in the male. Lower valvæ of ovipositor with strong, sharp teeth.

	♂ (type)	♀ (paratype)
Length of body	15 mm.	18.5 mm.
,, pronotum	2·75	3·5
,, hind femur	7·5	9·5

Described from one male and one female, taken at Ak-Tash, distr. Tashkent, 23, vii, 1920.

A very distinct species, showing a peculiar structure of pronotum and resembling somewhat in this respect *C. mitchelli*, m., from Kashmir.

The species is named after my much regretted friend, young and very promising Russian orthopterist E. V. Pylnov, who died prematurely from typhus as one of numberless victims of the recent disastrous events in our country.

Conophyma ikonnikovi, sp. n.

Allied to *C. fedtschenkoi*, Zub.

♂. *Antennæ* about as long as head and pronotum together . Head strongly reclinate. Frontal ridge shallowly sulcate, slightly widened between the antennæ, obsolescent near the clypeus. Vertex moderately sloping, nearly twice as long as broad, somewhat narrowed anteriorly, scarcely impressed without median carinula, with lateral carinulæ feeble. *Pronotum* cylindrical, very slightly widened posteriorly; its disc somewhat convex, gibbulose between the sulci, which are all three well developed; median keel well developed throughout, cut by the third sulcus and distinctly lowered at the second sulcus; lateral keels practically obliterate throughout, slightly perceptible only anteriorly where they are distinctly converging backwards, and between the sulci where they are very irregular and diverging backwards; metazona shorter than one-half of prozona, very feebly sinuate-emarginate behind; lateral lobes distinctly longer than deep, gibbose. *Mesonotum* somewhat longer than metazona of pronotum, with the median keel very feeble. *Metanotum* twice as long as metazona of pronotum, obtusely tectiform, with the median keel distinct and the lateral ones very obtuse and irregular, nearly obliterate. *Abdomen* with the median keel well developed on the first tergite only and subobliterate in the rest; lateral keels scarcely perceptible: irregular on the first tergite only. *Last tergite* with a broad, straight emargination behind, bearing in its middle two elongate obtusely conical, thick, slightly incurved lobes separated from each other by the space as broad as one of the lobes at its base. *Supra-anal plate* about as long as it is broad, trapezoidal, broadest behind; lateral margins strongly sinuate at the very base, straight in the rest; hind margin straight with a short rectangular lobe; hind angles a little less than 90°, rounded; surface impressed like a trough, with the sloping sides under the angle of 45°, and the median part (bottom of the trough) somewhat convex, sulcate along the middle in the basal third and, less distinctly, at the apex. *Cerci* quite twice as long as the plate, projecting beyond it by two-thirds of their length, practically straight, slightly compressed laterally at the base, inflated inwardly at the base of the apical third, with the apices pointed and very slightly bent outwards and downwards. *Subgenital plate* short, obtuse conical.

Coloration pale greenish-testaceous below, on the legs, apex of abdomen and face, above shining black, with yellowish-buff pattern. Head blackish above, with the postocular fasciæ scarcely perceptible, brown. Disc of pronotum dull black, in the metazona brownish, with shining yellowish-buff lateral fasciæ, which are obtuse-angulate inflexed at the first sulcus, diverging both forwards and backwards; surface of fasciæ irregularly punctured; lateral lobes shining black in more than upper half, greenish testaceous below, finely transversely rugulose, more densely so in metazona, and with fine scattered punctures. Mesonotum blackish-brown, dull, with the lateral fasciæ obsolete in front, much more approximated to each other than the pronotal fasciæ. Metanotum and the first tergite dull-black, with the lateral fasciæ distinct, still nearer to each other than in mezonotum. Pleuræ shining black, with an oblique yellowish fasciæ on metapleuræ. Abdomen shining black above and on the sides, with the median line and moderately broad, irregular lateral fasciæ, yellowish-buff. Hind femora with two very faint brownish fasciæ above. Hind tibiæ pale greenish-testaceous.

♀ (paratype). Blackish-brown, variegated and dotted with black, with the typical pattern in pale sulphur-yellow and broader than in the male. Lower valvæ of ovipositor acutely dentate.

	♂ (type.)	♀ (paratype)
Length of body (without cerci)	15.5 mm.	19
,, pronotum	3.5	4
,, hind femur	8.5	10
,, cerci	3	1.5

Two males and two females from Southern Bokhara, 1914.

Differs from *C. fedtschenkoi*, Zub., which has been only briefly diagnosed, in the very remarkable development of male cerci, as well as in other details of the male genitalia and in coloration.

The species is named after my friend Mr. N. F. Ikonnikov, who has done some excellent work on systematics of the *Acrididae* of various parts of Russia.

A list of species of the genus *Comophyma*.

1. *C. semenovi*, Zubovsky, 1898 ; Ann. Mus. Zool. Acad. St. Petersb, iii, p. 106 (Semiretchye).

   Synonym : *Podisma Almasyi*, Kuthy, 1905 ; Ann. Mus. Nat. Hungar., iii, p. 218 (Semiretchye).
2. *C. zubovskyi*, Uvarov, 1924 : see above (Ferghana).
3. *C. miramæ*, Uvarov, 1924 ; see above (Alexandravosky range).
4. *C mitchelli*, Uvarov, 1921 ; Ent. Mon. Mag., 3rd ser., vii, p. 268 ; also above (Kashmir).
5. *C sokolowi*, Zubovsky, 1899; Horæ Soc. Entom. Ross., xxxii, p. 588 (Tash kent.)
6. *C. uvarovi*, Semenov, 1915; Revue Russe d' Entom., xv., p. 453 (Kopet Dagh.)
7. *C. jacobsoni*, Uvarov, 1924 ; see above (Tchimgan, near Tashkent.)
8. *C. simile*, Zubovsky, 1899 ; Horæ Soc. Entom. Ross., xxxii, p. 591 (Samarkand district).
9. *C. plotnikovi*, Uvarov, 1924; see above (Malyi Tchimgam, near Tashkent.)
10. *C. pylnovi*, Uvarov, 1924 ; see above (Ak-Tash, distr. Tashkent).
11. *C. weberi*, Zubovsky, 1899 ; Horæ Soc. Entom. Ross., xxxii, p, 584 (Samarkand distr.)
12. *C. fedtschenkoi*, Zubovsky, 1900 ; Horæ Soc. Entom. Ross., xxxiv, p. 23 (valley of the upper Zeravshan).
13. *C. ikonnikovi*, Uvarov, 1924 ; see above (S. Bokhara).

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA.

(INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY.)

BY

T. R. Bell, C.I.E., I.F.S., (Retd.)

(Continued from page 305 *of this Volume)*.

Part XXXIV.

(With a text figure).

Sub-family (4)—Plastingiinæ.

This sub-family is composed of the genera, eighteen in number :—*Plastingia, Suastus, Arnetta, Zographetus, Lotongus, Zela, Nidari, Pirdana, Œrane, Creteus, Pithauria, Pithauriopsis, Pedestes, Suada, Isma, Scobura, Itys* and *Sebastinyma.* Of these the first, *Plastingia,* has eight species in British India and twenty more in Sumatra, Java, Borneo, Celebes and the Philippines. *Suastus* has six in British India and only three in Singapore and Java, the Philippines and Islands between these ; *Arnetta* has three which are all found in India and Burma ; *Zographetus* four in British India and three more outside in the Malayan Islands ; *Lotongus* three, with ten outside ; *Zela* one and another outside ; *Hidari* two, with seven foreign ; *Pirdana* two and five in the Malayan region ; *Œrane* is represented by a single species with two in Malayan countries ; *Creteus* is a genus of a single species ; *Pithauria* has two British Indian only ; *Pithauriopsis* has only one ranging from Assam to Borneo ; *Pedestes* two occurring respectively in N. W. Himalayas, Sikkim and Burma with another pair in Tonkin and Pulo Laut ; *Suada* has one, with three eastern relations ; *Isma* one and four ; *Scobura* one and eight ; *Itys* one and one and, finally, *Sebastonyma* a single species in Sikkim, Assam and Burma.

The four first genera are the only ones out of the eighteen that interest us and out of their twenty-one British Indian species only five come in here, a single *Plastingia,* two *Suastus* with one each of *Arnetta* and *Zographetus.* The early stages of two only are known. These two are *Plastingia submaculata* and *Suastus gremius.* It is a very small basis to found any conclusions upon :—incomplete information about two genera out of a total of eighteen. There is a very cursory reference to the larva and pupa of *Hidari thrax* in *Lepidoptera Indica,* (vol. x, p. 227,) from which we learn that the caterpillar feeds upon Palms—the cell would seem to be made much in the manner of that of *Hyarotis adrastus* (Cramer).

Imago.—The butterflies are of moderate size or smaller with the wings brown or blackish above, generally with subapical dots and a series of disc-spots on the fore wing; more rarely immaculate. The hind wing is immaculate above but has some black spots (or darker spots) below generally, often on a greyish ground.

Antennæ.—Not long but longer than two-thirds length of the costa of fore wing; the club gradual and bent over.

Palpi.—Various, porrect or otherwise, the third joint long or not.

Hind tibiæ.—Fringed and with two pairs of spurs; naked in *Pithauria Pithauriopsis.*

Fore wing.—Vein 12 ending before end of cell or at end of cell; cell less than two-thirds length of costa; vein 3 ends well before end of cell; vein 2 from middle or before middle; vein 5 very weak; discocellulars straight, outwardly oblique, faint.

Hind wing.—Vein 3 from close to angle of cell, vein 2 from after middle; vein 5 all but absent; discocellulars straight, inwardly oblique, faint.

Egg.—Dome-shaped, twice as broad as high or even much more; with some dozen or more strong meridional ribs from top to bottom; the whole standing upon a narrow, inclined basal ring or base. The surface is moderately shining. The colour is brownish or red with the ribs pure white.

Larva.—Of the ordinary hesperid *shape*, fattest in the middle, broadly rounded at anal end and there flattened; with a large, semi-elliptical *head* and a very distinct neck; the head is not bilobed. *Surface* of body is extremely minutely haired, the hairs hardly visible they are so small and there are some tiny, round shining glassy-looking spots on some of the segments. The *colour* is light green with the hair-dots darker.

Pupa.—Rather stout and with the frons only slightly prominent between the eyes with a more or less spatulate cremaster set round the edge with small hooked shafts. *Spiracles* of segment 2 provided with conspicuous large, more or less ear-shaped or semi-circular expansions. *Surface* set with comparatively long, more or less decumbent hairs, those on head pointing forwards, those on abdomen directed backwards. *Colour* more or less light green with a covering of cereous, white powder; the abdomen often with a yellow shade.

Habits.—The eggs are laid on the tops of the leaves of Palms including *Calamus* or Canes. The egg-larva and eggs in the only two known species are red-brownish or red as are the eggs they come out of. The larvæ make the same style of cell, one as the other, described below and eventually when about to pupate, cut it off the leaf so that it falls to the ground. The butterflies are fast fliers and rest with their wings upright over the back, sitting on leaves at night. They visit flowers and suck at bird-droppings on leaves and damp places in nalla-beds.

Genus 16.—PLASTINGIA.

Imago.—This is very like that of *Suastus gremius* in colouring having the same brown upperside with white spots to the fore wings, with a similar underside having black spots on the hind wings.

Antennæ.—Quite two-thirds the length of costa of fore wing; club slender gradual, rather long, gently curved at end which is pointed.

Palpi.—Prominent, curving round upwards; second joint densely scaled, third joint small, conical, obtuse.

Hind tibiæ.—Slightly fringed on the side and with two pairs of spurs.

Fore wing.—Neuration as in *Suastus gremius.*

Hind wing.—As in *Suastus.*

Egg, larva, pupa, habits.—See below under description of the only species *submaculata*, that is known in the early stages.

204 Plastingia submaculata (*Standinger*).—Male. *Upperside*; dark olive-brown blackish when quite fresh fading to olive-brown. Fore wing with a thick powdering of bright-yellow scales from base above cell and nearly to its end; some yellow, decumbent hairs below the cell also at base as far as inner margin; another streak of bright-ochreous scales just above vain from base to half the length of wing; two small white spots towards end of cell, the lower just above junction of vein 2 with bottom of cell, the upper further out; a 1·5mm.—square white, hyaline spot in interspace 2 below junction of vein 3 with end of cell and another similar, smaller in interspace 3 beyond and well separated from it; no subapical dots; and there is very little sign of fringe of hairs along inner margin. Hind wing without markings but with some decumbent, ochreous hairs from base in cell and extending below to beyond its end. *Cilia* of both wings whitish with the base brown as well as small brown areas at ends of veins. *Underside:* Dark greenish-yellow according to Colonel Swinhoe but really more grey with a slight lilac tinge and a sprinkling of ochreous scales along costa of fore wing and at base of hind wing. Fore wing with the lower half darkish-brown including cell but the whole of the area from the middle of interspace 1 to inner margin from base outwards to outer-margin along vein 12 shining white-ochreous; the white hyaline spots of upperside showing through, a quadrate brown spot bordering the one in interspace 3 exteriorly and, above this, an outwardly curved series of purple-tinged, brown, smaller spots in interspaces 4 to 8. Hind wing with black spot in middle of discocellulars at origin of vein 5 and an all-round series of black spots beginning with two in interspace 7, one in the middle and one further out forming the uppermost of a curve consisting of one about the middle of interspaces 6, 5, 4, 3 and just below this last in interspace 1 in which there is still another inwards about its middle; besides this the outer margin of the wing is narrowly brown sometimes stretching very slightly inwards in an obscure lunular manner, the anal angle more extensively brown. Antennæ black, the shaft with ochreous dots on inner side, the club with an ochreous medial band above, dull-orange beneath; palpi with the basal joint and underside ochreous, the upperside of second and minute conical, third joint (that is nearly hidden in the heavy covering of hair-like scales) dark-brown; head and body concolourous with wings, the head with ochreous scales, the thorax with ochreous hairs, the blacker abdomen with ochreous segmental bands, beneath the body is greenish-ochreous, the tibiæ and tarsi brown, the segmental bands of abdomen, whiter. The antennæ are strongly hooked, the club gradual and acute, about 9mm. long as compared with a wing-length of 16mm. Female exactly similar to male. Expanse from 35 mm. to nearly 40 mm.

Egg.—It is rather peculiar in *shape*: circular, the sides sloping and straight, the top broadly flattened with a smaller middle again somewhat convex; it is like a very broadly truncated cone with a height under half the diameter; the structure stands upon a 0·075 mm. broad ring or band which has a greater slope than the sides of the egg. The *surface* feebly shining and feebly cross-rayed between 14 or 15 meridional ribs, the number being sometimes 14, at others 15; these ribs are 0·05 mm. broad and about the same height and are flakily rough along their crests, they extend from the very outside circumference of the basal band (although only feebly indicated on the band) to the margin of a circular, smooth, slightly convex apical surface of 0·55 mm. diameter, in the centre of which is the 0.05 mm. wide micropyle; outside this smooth surface, and for a distance of 0·2 mm. from its edge, the surface is very regularly, transversely rayed between the ribs with little raised, flaky-crested low ribs which are 0·025 mm. apart; this clearly transversely rayed zone is produced outwards along each rib triangularly, for another 0·05 mm. and the top ends of the ribs, on the other hand, reach beyond it towards the apex; the ribs are 0·05 mm. apart at their apical ends and 0· 4mm. apart at the base of the egg. *Colour* brownish with the ribs and prominent cross-rays white. B. 2·2mm., H. 0·8 mm.

Larva.—Is of the ordinary hesperid *shape* with a large head compared to the neck and a body which is depressed on the ventral surface but otherwise circular in transverse section, stoutest in the middle, fining gently to each end, the anal segment being a semi-circle, sloping evenly with the rest of the body. The *head* is more or less regularly semi-elliptical in shape, but is higher than broad; the surface of head is reticulate-rugose, the reticulations forming irregular cells of about 0·1 mm. in diameter without hairs of any sort except round the edges of the ligula; the true clypeus is an equilateral triangle with a very acute apex; the false clypeus a very narrow strip outside it, gradually widening convexly to form a narrow arc over the true clypeus, the former reaching to just above the middle of face, the latter to just below; the labrum, glassy-soiled whitish in colour, is transverse, longer than half the true clypeus with its front margin square; the ligula more or less parallel-sided with the frontal sinus deep and triangular, the lobes on each side narrow, round-ended, the whole as long as the labrum and rusty-brown; the basal antennal joint is greenish, the second brown; the mandibles large, light-rusty with a narrow, basal much darker band and entire, dark-rusty-brown ends; the eyes are arranged in a gentle curve as concerns the top four, all equidistant from each other, the sixth 3 × as far from the fourth, and below it in a line with it and 3, the 5th behind 6 and 2 × the distance from it that 3 is from 4; the colour of the head is a light honey-yellow with a white, subdorsal, narrow band, more or less strongly expressed, this band broadening out and curving round above the mouth opening on each side of the clypeus; after this the labrum and ligula and a space on each side of clypeus above mouth-opening brownish; there may be a dorsal, brown line or even band from hinder margin to apex of clypeus, also the hinder margin of the head may be broadly brown and the neck opening is never without a thin line along it at any time and there is generally a short, brown, curved, dorsolateral line in the middle of the face from above the clypeus-apex down to the level of the clypeus base; the height of the head is 4mm., its breadth 3 mm. The *surface* of the body is transversely lined as usual from hinder margin of each segment forwards, there is a flat, glassy, lateral, tubercular, light-brown spot on the anal segment about 0·01mm. in diameter and several, shining, invaginated, similar tubercles, green in colour, in the dorsolateral region on segments 7-10; there are many, small, green, concave dots or tubercles (?) all over the body, some of which bear little glassy, conical tubercles, each surmounted by an extremely light, fine, erect hair hardly visible even with a lens; some 0. 5mm. long, similar, fine, white hairs along the free margin of anal segment. *Spiracles* rather small, oval, flush, yellow; those of segment 12 larger, those of 2 still larger and rounder. *Colour* of larval body is very glaucous, light green, the dots and spots, about from 0.05 mm. to 0.1 mm. apart, darker green; beneath yellowish-green. L: 25mm. when at rest; B: 4mm.

Pupa.—Is rather like that of *Suastus gremius*; the *shape* somewhat stout in the front part where the head is broad with prominent eyes, and slightly bowed, rather square in front and, with segment 2, slightly constricted laterally at hinder margin; the shoulders about the same width as head, then about the same breadth until segment 8 after which the body tapers to the end gradually; the transverse section from segment 3 to segment 12 is circular; the frons is in a plane perpendicular to the longitudinal axis of the pupa, the vertex inclined thereto at an angle of about 30°, with the hinder margin straight; segment 2 a transverse band, about as long as the vertex of head, with the hinder margin straight and, at the lateral ends, curved strongly forwards to take the upper ends of the ear-shaped spiracle-expansion which is very large; the thorax very little humped, the hinder portion parallel to the longitudinal axis of the pupa, the front portion in a plane very little inclined towards it, the hinder margin a parabolic curve meeting the wings in a very shallow, broadly rounded angle of about 90°; segment 4 rather shorter than segment 2 which is, in its turn, about one-fifth the length of thorax; segment 5 slightly longer than segment 4; segment 6 nearly half as long again; 6 to 11 about co-equal with this last; 12 shorter by about one-third; segment 13 not half 12; the anal segment with the basal half solid, more or less conical, round topped, the diameter at base about equalling the height with the latter half produced out in the same plane as the longitudinal axis of the pupa from its dorsal surface, flat, spatulate, with the suspensory hooklets (here they are simply fine hairs) at the very extremity, the dorsum limited on each side by a prominent ridge which runs backwards, the two converging strongly towards each other towards the hinder margin, the basal, solid portion of the segment with its dorsal surface inclined to the other half very slightly, the ventral portion of the basal half occupied by the scar of the anal prolegs inclined from the perpendicular (to the longitudinal axis) forwards considerably; *head* with the small clypeus triangular, the ligula (?) a small diamond let in between the two halves of the proboscis, this proboscis exceeding the wings and free beyond their ends, though pressed into the surface, as far as the middle of segment 9, slightly thickened before end, the fore and midlegs embraced by the antennæ which are curved in at their ends and reach to about three-quarters the length of wings; the hind legs appearing on each side of the free proboscis-tip, themselves also there free, both between the somewhat produced apices of wings; the antennæ are cross-rayed only on the clubs. *Surface* of pupa rough with transverse rows to each segment of appressed, bristle-like hairs directed regularly backward: some short, erect hairs, fine and longer, on cremaster and all ventral proleg-scars as well as on the head; the segments well-marked. *Spiracles* of segment 2 with a large, ear-shaped (semi-circular) red-brown, slightly raised expansion, its diameter on the common margin of segments 2, 3, its surface shelving to the perforation, near its anterior, lateral corner, with a fringe of stiff bristles lying across the perforation from the portion of the base not occupied by that perforation, this expansion is about as long as segment 2(the length of expansion considered to be transverse to pupal length); the other spiracles very small, shining, raised, roundly oval, darker than the colour of the body. *Colour:* the head green with a shade of brown; the thorax green; the abdomen waxy yellow; the whole covered over with a white, cereous powder. L: 20mm. B: 5mm.

Habits.—This butterfly was discovered in N. Kanara some twenty or more years ago by the writer of these papers sitting on a leaf of *Calamus pseudotenuis*, Becc., a very common species of Cane in the evergreen jungles of the District where it often forms dense thickets that are extremely difficult to get through because of the excessively spiny stems of the plant and its long *flagella* or whip-lash like productions of the stem-sheaths (it is these that are so thorny) that hang down from above in all directions, set at short intervals along their length with a half-ring of three or four very stout, hooked spines that are thick at the base, short and excessively sharp. After that the quest for the larva was a long one and success was a long time in coming. Perseverence, long searchings and a great measure of patience finally brings its reward in everything and so it was here.

The discoveries are chronicled in *Lepidoptera Indica,* vol. X, p. 218 by Colonel Swinhoe published in the year 1912-13. The habits of the butterfly are there given in a condensed form from information gleaned in Kanara. The eggs are laid on the uppersides of leaves, always singly, often on the withered leaves near the ground, as the insect likes dark places for the purpose of oviposition; although they may be laid on perfectly green, fresh leaves further up where there is plentiful, thick shade from overhead trees. These canes are extensive climbers growing to the height of large trees they find as supports but many seedlings are always to be found which start as ordinary palm-like growths before they begin to climb. The butterfly has never been seen in the open and is impatient of prolonged exposure to sun. It flits about very rapidly in the checkered shade in short flights, settling with closed wings in little spots of sunlight on the uppersides of leaves. It visits flowers sparingly but may be seen sucking the moisture out of bird-droppings that fall on leaves; but it is at all times a scarce thing to see and its capture is always an event to be remembered. The caterpillars, however, when diligently hunted, are not very difficult to find and the skippers can always be bred from them. Cane withers quickly and, where it has to be brought from a distance, does not last for more than a day or two in a fit condition for food. The larva makes a cell very much like that of *Suastus gremius* but the edge of the cover is always scolloped all round the edge. The original cell, the one made by the egg-caterpillar, is an oblong piece of the edge of the leaf turned over on to the underside and is very tightly closed all round the free margins except at one end next the hinge where the hole of entrance is situated against it. This method of building is kept up to the end except that, of course, finally, the midrib of the leaf is made to serve as hinge; and, often, this cell is then isolated in the middle of a long length of midrib as the leaf is eaten away completely on both sides; the side towards the tip of the leaf is often out off and, in the end, when the time for pupating has arrived, the midrib at the other side is also gnawed through before the final closing of the habitation, with the result that the whole house descends to the ground. Just before the end the lining of silk inside the cell is thickened, both ends are webbed strongly and the larva emits from the body between the prolegs at the sides, a cereous powder which is spread all over the interior both on webbing and lining. The use of this powder is to keep out the damp or wet and it does so very effectively. Canes often grow over nallas and in more or less swampy places so that the cells, when cut loose, drop into water which would in the ordinary course get in and drown the caterpillar. Most of the breeding goes on in the monsoon months and everything, then, in the places where cane grows, is of course extremely wet. The leaves and ground-rubbish get swamped down the hills, as often as not and, with it, the cells that lie amongst it. If one of these is examined it will be found that not a drop of water has got in—they fetch up between stones or amongst heaps of dead leaves left after the flow of water has stopped. One of the most satisfactory ways of collecting specimens is by looking for fallen cells under cane-bushes upon which are the signs of eating. Often they are to be found where they have dropped for, naturally, many escape being flooded away—when they have come from bushes that happen to be situated upon slightly raised ground out of the way of the course of water in the form of moving currents. The style of eating is not at all difficult to recognise for several reasons. To begin with most larvæ make several cells before they are contented, or make several efforts at it, with the consequence that there are generally more than one entire end of leaf upon the ground below—the part cut off beyond the cell. Upon the plant exist the remains of the partially completed ones. Then there are the signs of eating during the caterpiller's whole life—quite a considerable amount; and the remains of the various sized houses it has made as it became larger and larger. One of the best ways to rear larvæ is to tie them out upon cane-bushes under a mosquito net; there they are practically in natural conditions and undisturbed; they make their regulation number of cells and can stick to each as long as they like. In cages in a bungalow the cells naturally wither with the leaf and it is sometimes difficult to keep them, for the larvæ are prone to desert withered habitations and have to make new ones at short intervals. This interferes with their growth and one gets small specimens of the imago. In a cage it is advisable to cut the cells away from the original leaf and pin them on to the new one whenever change of food is necessary as it avoids too frequent disturbance of natural habits. The growth of these larvæ is rather slow and, notwithstanding that Cane is an evergreen plant, towards the end of the monsoon, though there never at any time can be a want of fresh food, they will remain unchanged in the fallen cell for quite long periods before pupating—probably during the quiescent stage of the sap and consequent comparative want of moisture in the leaves. Colonel Swinhoe informs us that the type came from Palawan Island of the Celebes group; that de Nicéville records it from Kanara (the one recorded above), Cachar, the Daunat Range, Burma, Parak and Pulo Laut. And he says "Davidson, Bell and Aitken also record it from Kanara, their specimen, which was submitted to de Nicéville and identified by him, a perfect specimen, has been lent to us for figuring; before seeing de Nicéville's notes in the Journal of the Asiatic Society of Bengal we had come to the conclusion that the two *Pedestes* erected by Elwes and Edwards, *maculicornis* and *fuscicornis*, with recurved terminal crook to their antennæ, were indentical with *Plastingia submaculata.*"

Genus 17.—Suastus.

Imago.—These are medium-sized butterflies with the coloration always dark-brown on the uppersides of both wings and on the undersides of fore wings; the undersides of the hind wings often washed or covered with grey scales and with black spots between some of the veins. The fore wings generally have subapical hyaline dots and a series of discal hyaline spots.

Antennæ.—Long, nearly two-thirds length of costa of fore wing, the club gradual, the tip shortly bent over.

Palpi.—Upturned, curving over head, second joint densely scaled, the third slender, long and pointed.

Hind tibiæ.—Fringed and with two pairs of spurs.

Fore tibiæ.—With epiphyses.

Fore wing.—Vein 12 ends on costa before end of cell; vein 11 from upper middle of cell and free; vein 5 a little nearer 4 than to 6; vein 3 emitted some distance before end of cell, 2 from well before middle; cell less than two-thirds length of wing; upper discocellular short, distant; middle and lower discocellulars inwardly oblique and in a straight line; costa gently, evenly arched, apex subacute, the outer margin convex; inner margin about as long as outer in male, rather shorter in female.

Hind wing.—Vein 7 emitted slightly before end of cell; 5 not visible, vein 3 from close to end of cell with 2 from one-fourth before end; discocellulars straight, inwardly oblique; costa arched before base, outer margin evenly rounded.

The above description would absolutely suit *Plastingia submaculata* Staud., except that the third joint of the palpus is quite short.

There are two species existing in Bombay, six in British India, the two here being *gremius*, F. and *bipunctus*, Swinh., that are distinguished by the undersides of the hind wings most easily, the former being grey with a number of clearly defined jet-black spots; the latter having that underside slightly ochreous with a single black spot at end of cell.

Egg, *larva*, *pupa* and *habits* are only known for *S. gremius* and are all described in detail under that species.

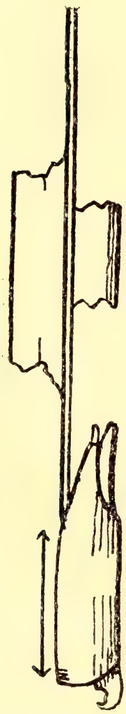
205. Suastus gremius (*F.*).—(Pl. M, figs. 79 ♂, 79a ♀).—Male. *Upperside*: olive-brown. Fore wing with ochreous-white spots, a small one in the middle of the discocellulars, sometimes a minute one above it, three subapical, small spots, the uppermost usually minute; three larger, discal spots in an oblique line, the upper one before the middle of interspace 3, the second somewhat oval and before middle of interspace 2, the lowest about middle of interspace 1; these spots varying a good deal in size. Hind wing somewhat paler than fore wing with a broad, dark margin, being without the long, decument, yellowish hairs that occupy the rest. *Cilia* of both wings brownish-ochreous. *Underside:* grey with a slightly-lilac tinge when fresh. Fore wing with the inner portion below the subcostal vein suffused with blackish leaving the apex broadly grey; the spots showing through from the upperside with the one in interspace 1 blurred, narrower and longer than on upperside. Hind wing clearer grey, sparsely covered with whitish scales, a black spot near upper end of cell with three in an oblique row in interspaces 1, 2, 3 and 6, all ringed with whitish, a white streak along vein 1. Female. Usually paler than the male with the markings similar but the spots on the fore wing much larger, the two upper, discal spots square, the middle one excavated on the outer side ; two conjoined, large spots at end of cell. Antennæ black, speckled obscurely with white, tip of club dull orange, the underside of it at base and upper end of shaft white; eyes bordered white behind ; body and head above more or less concolorous with wings, the thorax in fresh specimens with a greenish gloss ; the abdomen with obscure, greyish segmental bands ; underneath : the palpi, chest and abdomen and legs grey, the tarsi with an orange-brown tinge. There is only the very slightest fringe of hairs along inner margin of fore wing ; fore wing with ochreous scales at base and broadly along inner margin to the middle on the upperside. Expanse 35-45mm.

The males are almost invariably smaller than the females. In underbred specimens, such, that is, that are starved, the black spots on the underside of hind wing tend to disappear. Amongst many dozens that have been bred in Kanara and elsewhere there was a very large preponderance of females, perhaps four times as many as males.

Egg.—The *shape* is that of a hemisphere more or less, the top somewhat flattened ; it stands, besides, upon a narrow, inclined, colourless rim or foot. *Surface* moderately shining and minutely cellular-pitted as well as extremely finely cross-rayed, the rays being about 0·025mm. apart ; besides, there are thirteen broad, high, meridional ridges from the base to near the apex where they lose themselves in the surface; their greatest breadth is 0·05 mm. which is about equal to the intervals between them at the top where they disappear : they are rounded in transverse section and finely pitted ; the micropyle-surface occupies the apex of the egg and is circular, 0·035 mm. in diameter ; round the base of the egg the ridges are 0·035 mm. apart. *Colour* of the egg is dark red-brown with the meridional rays pure enamel-white; turning black before the larva emerges ; finally whitish. B. 1·5 mm.; H. 0·85mm.

Larva.—The *shape* is that of the *Baoris* group owing to the flat anal segments and the habit of the larva of hunching its body in front and lying closely applied to the resting-surface ; the anal end is broadly rounded, somewhat thickened round the margin and, therefore, depressed just inside the margin, the dorsum being considerably flattened, the dorsal line sloping at an angle of about 20° to the longitudinal axis ; segment 13 is a short, transverse strip ; segment 2 is much narrower than the head as well as thinner all round and is unmarked except for the large, deep-brown spiracles ; the body is stoutest in the middle when stretched and moving but about segment 5 when at rest and hunched up with segments 1-3 contracted, the head laid back. The *head* is more or less oval, higher than broad but, of course more or less truncated across mouth-opening; it is rounded on vertex with the central dorsal line hardly depressed on vertex, the surface is rather distantly pitted ; the clypeus less than one-quarter the height of the face, acutely triangular, slightly longer than broad ; the false clypeus is a narrowish strip outside it, not very distinct, half the height of face, the apex rounded ;the labrum is transverse, red-brown as is the more or less parallel-sided ligula with its deep acutely angled sinus on the front margin ; the mandibles and second, antennal joint are red-brown, the antennal, basal joint light in colour ; the eyes, arranged in a gentle circle of four with the other two far below and behind, are white with the middle two of the curve black; there is a fringe of rather long, porrect, reddish hairs along the edge of the mouth-opening but no others. The colour of the head is whitish remaining pure in a band across face just over the mouth-opening and labrum as well as on the cheeks between a more or less oval patch on each lobe that starts thin on each lobe-vertex and broadens out towards middle, ending at transverse band over labrum and another triangular patch at base of cheeks behind the eyes: both patches being suffused, darkish brown with light spots (not regular) of ground-colour showing on them ; besides this the hinder margin of head is narrowly darker brown sometimes coalescing with the basal cheek-patch; the central (dorsal) line of head is sometimes ground-colour, sometimes has a dark line down the middle of it as far as apex of false clypeus ; the true clypeus has a fine brown border and there is a chevron-shaped black mark forming the upper half border of the false clypeus over the apex of the true clypeus. The *surface* of the larva is dull, smooth, except for extremely minute, erect, light hairs, visible only along the dorsoventral line where they are a bit longer ; there are six strong, reddish, much longer hairs pointing straight out round the anal margin;the segments are quite distinctly marked with the usual transverse folds on the posterior portions; also the usual hair-tubercles (subdorsal, dorsolateral, supraspiracular, &c.) are present as minute, shining raised ovals which are rather difficult to see; the flat, dorsal surface of the anal segment is minutely roughened-tubercular. *Spiracles* are of ordinary size roundly oval, slightly raised, dark-brown ; those of segments 2 and 12 much larger. *Colour* of body is glaucous-green, spotted all over with small, darker green dots except segments 2, 3 and the anal segment; the anal segment margined round the free margin with whitish and there is a very dark-green, dorsal slightly pulsating, thin band or broad line from segment 4 to segment 13 ; ventrum darkish green. L. 27 mm.; B. 4·5 mm.

Pupa.—It is more or less typical in *shape*, slightly bent down at the anal end, the dorsal line from segment 8 to end forming a considerable curve, the ventral line being straight throughout except at segment 13, whence it is also bent: the broadest part of the pupa is at the point of the shoulders whence the breadth decreases very gently as far as the hinder margin of segment 10, thence more rapidly to the extremity of 13 after which follows the still more rapidly decreasing cremaster : this cremaster is more or less triangular in shape and the posterior half is somewhat suddenly narrowed to a conical point, the dorsal surface of the whole cremaster from base to just before the absolute extremity being flat and bordered laterally by a raised ridge ; at the apex of the point—the absolute extremity of the pupa that is—there is a minute truncation and it as well as the lateral surface of the cremaster are clothed with stiff, bristle-like hairs sparsely, the hairs being red, extremely minutely and distantly feathered under a strong lens, reddish in colour and directed backwards: the whole cremaster is red-brown in colour ; segment 13 is, practically speaking, the transverse base of the cremaster and is about half its length, becoming non-existent ventrally segment 12 is about as long as 13 and only little shorter than 11 ; segments 10,9 slightly longer than 11 and very slightly shorter than 6-8 ; segment 5 shorter than 6 and 4 very short—all these comparisons being taken on the dorsal line ; segment 4 in the dorsal line forms part of the dorsal, posterior slope of the thorax and its lateral portions are much broader because of the hinder margin of the thorax meeting the wings in a widely open, rounded angle of about 80° ; the hinder margin of thorax is a gentle curve of less than a quarter circle and a very even curve ; the hinder margins of head and segment 2 (front margin of thorax) are absolutely straight and parallel to each other and throughout at right angles to the longitudinal axis. *Head* is very broad, little less broad than the pupa at shoulders and the front slop of the thorax, the dorsal slope of segment 2 and that of the head-vertex are in absolutely the same plane of about 30°



Suastus gremius.

Cell of pupa on palm leaf.

to the longitudinal axis of the pupa: the head-vertex is more or less flat; the frons, which is in a plane nearly at right angles to the longitudinal axis, is only slightly convex and slightly depressed in the dorsal line; the whole head is slightly constricted behind laterally; segment 2 short: about equal to segment 5 in length, measured on the dorsal line; the thorax is only slightly convex, the apex being close to the front margin whence the dorsal slope to hinder margin is slight and nearly straight. The *surface* of the pupa is dull except on thorax, head and wings which are slightly shining; transversely, irregularly, finely aciculate-rugose on the first three segments, more roughly similarly rugose on the rest; the abdomen and thorax and vertex of head bear a sparse covering of stiff, reddish, simple (under a strong lens extremely minute and distantly feathered) hairs which are directed forwards on the head, segment 2 and thorax and backwards on the other segments; the wings are naked; the proboscis reaches just beyond the hinder margin of segment 8; the bevilled edges of segment 9, 10 (and 8, 11) present nothing peculiar and are all not strongly developed. *Spiracles* of segment 2 rather conspicuous by reason of a strong thickening in the shape of a 1mm. long slightly curved oblong on the front margin of segment 3 which faces slightly forwards and dips into the spiracle-opening, faced, on the depressed portion of the hinder margin of segment 2, by a fringe of stiff, minute hairs which extend back over that opening at the upper end; the oblong is red-brown in colour and tubercular-roughened; the rest of the spiracles are longly oval, not large, slightly raised and very light soiled-yellow in colour. *Colour* of pupa is grass-green on head, segment 2 and thorax and wings; the rest being a very light greenish-yellow. The whole covered over with a white, cereous excreted powder more or less densely. L: 18mm. B: 4mm.

Habits.—The egg is laid on the top surface of the leaf and, generally, near the point or an edge. It is laid single, although, as often as not, two or more are laid on the same plant. The leaves chosen for oviposition are generally such as are neither very young nor too old and tough. In three days' time the young larva eats its way out at the top of the egg making a circular aperture exactly large enough for the big head to come through, when it emerges without ado. It sometimes eats the shell, sometimes not, before wandering off down the leaf and, sometimes, on to another. Generally, however, it does not go far but chooses a place at the edge where it commences to eat a short line from the margin inwards for about a distance of its own small length; then another, a short way further on, thus making a short, free, oblong piece which it turns over on to the upper or under surface and fastens down tightly along the long edge, leaving the two short ends free. In this manner it makes a more or less oblong cell in which it takes up its abode and gradually lines thickly and very strongly with a dressing of web—single silks woven in every direction until a very perfect matting or thin cloth is formed. The first stage is passed in this. As it grows, in the second and third stages, it makes a new and larger cell in exactly the same way. In the last but one and the stage before pupation, when it is full grown, it makes the cell much in the same way but uses the whole half-side of a blade or segment of leaf—the term "leaf" is erroneously used above for a segment or blade—for the purpose. At first it ventures only just outside the cell but, later on, as it gets bigger, often wanders quite a long way to feed. When full-grown and fully fed it makes a cell in a similar fashion but closes it at one end completely and draws the purposely fashioned, jagged pieces of leaf at the other end together loosely; the inside is coated thickly with a carpet of silk, the loosely closed end is spun with a few cross-silks amongst which are incorporated little pellets of the white cereous excretion of the larva; at the closed end of the abode are generally a few pellets of the *excreta* and the discarded skin. The pupa is but very loosely attached by the end of cremaster to the silken carpet, often it is not fastened at all—indeed there are no hooklets existing by which the attachment could be effected in any but a slight way. The egg-larva is generally red, bright red and this red hue subsists up to the end of the second stage and, slightly, into the third; after which a greenish coat is assumed to culminate in the glaucous-green of the mature caterpiller. Prior to fastening up the pupal cell, the larva often still eats a little and, always, gnaws away the blade on each side of the midrib for some way behind as well as the whole portion of the blade towards the tip which then falls to the ground. The midrib still attaching the abode to the plant is then partially eaten through so that, generally, after a bit, the cell, with the pupa in it, falls to the ground where it is often swamped away by rain or blown about by the wind. The mixture of cereous matter with the web in the part of the cell in front of the pupa, the loosely closed end is seemingly designed to prevent the ingress of water which it certainly does most effectually. The rest is too tightly cemented together to let anything in. The genus *Halpe* (at least as composed of the species *hyrtacus*, *astigmata*, *moorei* and *honorei*) adopts a similar method of guarding the pupa against death by drowning for the larvæ of the insects composing it all cut the cells loose from the leaf of the foodplant when about to pupate. The skipper *Suastus gremius* is an insect with a robust thorax and wings well adapted to rapid flight. It *has* a very strong flight and extremely quick as well. It is difficult to follow with the eye when on the wing and never dawdles about or flutters or hovers: it is suddenly there, on a flower or on a leaf and, the next instant, it is gone; the line taken is, as far as can be observed, fairly straight and with very little "skip" in it; although it turns with ease and great suddenness from its course when it so desires. It comes readily to flowers and may also be found, occasionally, sucking moisture on the ground or on the top of a leaf; it is quite commonly found tasting bird-droppings on leaves in the jungles with its long proboscis. It is fond of sunlight though, where possible, the eggs are laid in shaded spots. The male basks with the hind wings depressed horizontally, the fore wings slightly open; but it is not, on the whole, a basking butterfly and is practically never found on the tops of high hills amongst these species that indulge commonly in that habit. The foodplant of the larva consists of species of palms, and generally, in India, among the indigenous ones, that most affected is the wild date-palm, *Phœnix sylvestris* which is found in many parts of India ; Bengal, Guzerat, Western Peninsula, Coromondel Coast in its different forms : *humilis* from India, China and Cochin China ; *acaulis* in Kanara, North, Central and Western India, Burma ; *robusta* from the Deccan. The distribution of the butterfly is India, Ceylon and Burma.

The larva also feeds upon several of the introduced species of palms, especially commonly on a small, fan-leafed one which is grown in the verandahs of bungalows in Bombay ; also upon the wild *Caryota urens* or Fish-tailed Palm. It is certain to eat others also.

The black spots on the underside of the hind wing of the butterfly may vary in number as, in the dry weather, they seem to be liable to disappear or only exist as small, whitish marks—some, however, are always present. Swinhoe has named what he considers a separate species from Southern India *Suastus bipunctus* from the fact that only two of the black spots are present on the underside of the hind wing. It is quite probable that the form is only one of the dry-weather *gremius*.

The figures of the imago, 79 and 79a of Plate M, are not at all good in the matter of colour although correct in pattern. The female insect, 79a, is the better of the two but the underside—the pair of wings on the right—is too pink and the grey of the hind wing should be quite clear or pure. The male underside, right-hand wings of figure 79, should be similar to the female ; in the picture they **are** absurdly dark.

206. Suastus bipunctus (*Swinhoe*).—Male and female. *Upperside* : black or very dark blackish-brown. Fore wing with three or four minute, white spots in an oblique line across the disc, varying somewhat in size and number in different examples, one in each of the interspaces 2 and 3 and two towards apex ; in the female the spots are usually larger and the lower spot is quadrate ; but all these spots vary much in size in both sexes in different examples. Hind wing without markings. *Cilia* of both wings blackish-brown. *Underside* : paler than the upperside. Fore wing with the spots as above and a small suffused white space in the middle of interspace 1. Hind wing paler than the forewing, the inner portion suffused with ochreous scales, a dark spot at end of cell and a discal series limiting the ochreous suffusion. Antennæ black with whitish dots on the underside ; palpi, head and body blackish-brown above and below with white hairs on the underside and whitish, segmental bands on the abdomen with a whitish patch at its base ; legs blackish-brown. Expanse 30-35mm.

The habitat is given as Nilgiri Hills and Burma by Colonel Swinhoe from whom the above description has been taken (*Lepidoptera Indica,* vol. X, p. 152). He states that the type is in the B.M. and several examples of both sexes are in his collection from the Nilgiris and in the B. M. from Haundraw, Attaran Valley and the Daunat Range, Burma. A single specimen was caught in Kanara District in the Bombay Presidency but no other has ever been seen. It must be a very rare species in Bombay and nothing is known about the early stages in consequence.

Genus 18.—Arnetta.

Imago.—This genus consists of three species ; *vindhiana* from S. India, *atkinsoni* from Sikkim, Assam and Burma ; and *binghami* from the Salween Valley and Tavoy in Burma. They are all medium sized butterflies with the appearance of those of the genus *Parnara,* that is olive-brown on the uppersides with immaculate hind wings and mostly small-spotted fore wings (apical and discal, semihyaline white spots) with the undersides variously suffused in a clouded manner with russet or yellowish-brown and with some obscure whitish dots. *Vindhiana,* the only Indian Plains species is apparently confined to S. India. Swinhoe gives its distribution as follows :—" The type comes from Jubbulpur ; Evans records it from the Palni Hills ; we took it at Matheran, Lanaoli and Mhow ; Betham records it from the Central Provinces ; Aitken and Comber from the Konkan ; Hampson from Nilgiris and Aitken from Thana near Bombay ; the types of *nilgiriana* and *modesta* are from Koonoor.'' It is quite plentiful, really common, throughout the Surat Dangs and west Khandesh District but has never been seen in the heavier jungle-country south of Bombay in the Presidency, that is in Belgaum, Dharwar or the S. Kanara Districts. In the Surat Dangs a hundred might be caught any morning. They were found there sitting on the ground on dry leaves, blades of grass, &c., and often would get up by the dozen as one walked along under the teak trees. They may be said to live in dry bamboo-growing hilly country. The general flight is very similar to that of *Parnara* as is also the way of sitting ; they visit flowers busily and play about much in the same way as the insects of that genus. The foodplants are unknown—if, indeed there is more than one ; and this, notwithstanding diligent search in the Dangs extending through weeks.

Antennæ.—Less than two-thirds the length of costa of the fore-wing ; club slender, moderately long and with a short, pointed crook.

Palpi.—Palpi porrect, second joint densely sealed, third joint projecting horizontally in front of face, short and obtusely conical.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Vein 12 reaches costa opposite end of cell ; discocellulare suberect, the lower a little shorter, 5 arising a little below the middle ; 3 from one-sixth before lower end of cell ; 2 from middle ; cell less than two-thirds length of costa ; costa gently arched, apex subacute, outer margin convex and about equal to inner margin.

Hind wing.—Vein 7 from close to upper end of cell ; discocellulare and vein 5 faint ; 3 from close to lower end of cell, 2 a short distance from bass of 3 ; outer margin evenly rounded.

Egg, larva, pupa.—Unknown. The larva probably feeds upon some coarse grass ; but this is only a conjecture.

207. Arnetta vindhiana (*M.*)—Male and female. *Upperside* : Olive-brown with a slight ochreous tint. Fore wing with no fringe of hair on inner margin and none on base of wing or elsewhere ; a small, hyaline-white spot at upper end of cell ; three subapical, similar dots near bases of interspaces 6, 7, 8 in a nearly straight line downwards and two larger, quadrate spots one immediately below the other and touching, the upper, smaller in base of interspace 3, the other, longer, in the middle of interspace 2. *Cilia* of both wings grey or ochreous-grey with the bases brown. *Underside* : light rusty brownish-grey (Swinhoe calls it "brownish-pinkish-ochreous"). Fore wing : the middle portion from base to near outer margin blackish-brown, spots showing through from upperside. Hind wing : (the upperside of this is immaculate with longish, brown hairs in cell and on hinder half.) One indistinct, rusty spot at end of cell and one or two more in a straight line above it ; an indistinct series of similar, discal spots between the veins well beyond the cell. Antennæ blackish-brown, banded with yellow narrowly on top, completely yellow below and dull orange-red at tip of club ; palpi, head and body brown above with some ochreous, short hairs ; beneath greyish-white. Expanse 30mm.

All that is known about this species is given above under the genus under " *Imago*."

Genus 19.—ZOGRAPHETUS.

A genus of four species in British India—there are three more in the Malayan Sub-region. In British India there is *satwa* from the N. W. Himalayas, Sikkim, Assam, Burma ; *flavipennis* from Sikkim, Bhutan, Burma and the Andamans ; and *flavalum* from Sikkim (a unique specimen at the time it was described). The only species that interests us is *Zographetus ogygia* from South India, Burma, Borneo and Sumatra ; the type coming from Sumatra was named by Hewitson. The single specimen that was obtained in S. India came from Kanara and was identified by de Nicéville ; it was caught near the sea-coast in semi-evergreen jungle, about 800′ above sea level during the monsoon. That was many years ago and nothing has ever been seen of it since.

Imago.—The butterflies are rather like *Arnetta* in facies; are medium-sized and brown on the uppersides with the usual *Parnara*—like hyaline-white spots on the fore wings and occasionally also on the hind wings. Underneath they are all yellow of different shades, rusty or brownish, and have discal, black spots between the veins, variously arranged.

Antennæ.—About two-thirds the length of costa of fore wing, the club moderate, elongate, the point short and crooked.

Palpi.—Slightly upturned, second joint densely scaled, third obtuse-conical.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Males with two pairs of linear, glandular streaks on the upperside ; the upper pair on either side of vein 2, at its bifurcation, the lower two immediately beneath these on either side of vein 1. Vein 12 ends at a little before end of cell on costa ; discocellulars suberect, the lower slightly shorter than the middle one, vein 5 nearer to 4 than to 6 ; vein 3 from near lower end of the cell, 2 close to base of cell ; costa gently arched, apex somewhat produced subacute ; outer margin convex, shorter than hinder margin.

Hind wing.—Vein 7 slightly before one-third before upper end of cell ; 3 from near lower end, 2 from one-fourth before end ; lower margin of cell slightly angled at vein 2 ; outer margin rounded in male, somewhat produced at apex in female.

Egg, larva, pupa.—Unknown.

Habits.—As far as they are known for *ogygia,* these are given above.

208: Zographetus ogygia (*Hewits.*).—Male. *Upperside* : dark-brown. Fore wing with two yellowish-white spots at end of cell, the upper minute ; a larger, subquadrate spot immediately below them in interspace 2 ; a small round spot close outside the junction of the subquadrate spot with the lower cell spot m. interspace 3 ; a small spot above in interspace 6 and two minute dots immediately above it forming the subapical series. Hind wing without markings. *Cilia* white with thin, brown base. *Underside* : paler, of a pinkish-brown colour. Fore wing with its middle narrowly blackish spots as on upperside. Hind wing with a brown spot in cell, another at its end and a discal, curved series between the veins, all very indistinct. Antennæ black, ringed with white, the upper part of the club white on the underside tip orange-red ; palpi, head and body above and below including the legs, concolourous with the wings.—Female. Like the male but with an additional whitish spot in discal series of fore wing in interspace 1 against the middle of the submedian vein ; and the ground colour of the underside of the hind wing is paler. Expanse 35mm.

Habitat.—Burma. S. India, Borneo, Sumatra.

Distribution.—The type is from Sumatra ; Watson records it from the Chin Hills ; Davidson, Bell and Aitken from Kanara ; it is in the B. M. from Thoungye, Burma; Elwes records it from Pulo Laut and Labuan. (*Lepidoptera Indica*, vol. x, p. 188).

Egg, larva, pupa, habits.—Unknown except as mentioned above.

Sub-family (5)—ERIONOTINÆ.

Imago.—All have the eyes red, a character that lasts for years after death. The subfamily consists of five genera in British India; *Erionota, Gangara, Pudicitia, Paduka* and *Matapa.* The last consists of medium sized insects, the others comprise some forms that are the largest of the Skippers with others that are well over the medium dimensions. Nearly all, except *Matapa* (with 5 species) and *Paduka* (one species, *lebadea*) males which are immaculate, are marked with exceptionally large, hyaline, discal spots of a generally golden yellow colour (*Erionota attina* only has them grey-white) on the fore wings.

Antennæ.—More than half the length of fore wing, the club gradual, acuminate, the end bent over.

Palpi.— Upturned in front of the face ; second joint densely scaled, pressed close against the face ; the third joint concealed.

Fore tibiæ.—With epiphyses.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Vein 12 ends on costa about end of cell ; 11 free ; the cell comparatively short, 3 from near its lower end, 2 from about its middle.

Hind wing.—Vein 7 from before end of cell, 3 from near end, 2 various ; discocellulars faint, 5 not traceable, outer margin slightly sinuate.

Egg.—Dome-shaped about twice as broad as high with about 40 thin meridional ribs that are difficult to see ; the colour white or pinkish for *Gangara thyrsis* and *Matapa aria.*

Larva.—Somewhat elongated, anal end rounded, head large compared to the neck, heart-shaped or rounded, black or grey (in which case it is spotted-*Paduka*) ; covered (in *Erionota, Gangara*) with a thick coat of cereous excretion which, in the case of *Gangara thyrsis,* takes the form of numerous short threads ; in *Matapa* and, apparently, in *Paduka,* naked, the colour is white or grey ; *Gangara* has red markings under the cereous covering.

Pupa.—Rounded at fore-end but with a more or less conical boss between the eyes in cases (*Paduka* apparently and *Erionota thrax*) ; abdomen elongated with end turned down and a strong cremaster ; the proboscis generally slightly reaching beyond ends of wings free ; in *Gangara thyrsis* of extraordinary length the free portion reaching a length of 30 mm. while the whole length of pupa is only 35mm.

Habits.—The butterflies are all crepuscular ; they fly first thing in the morning or just after sunset in the evening and visit flowers, settling upon them to suck their juices. The flight is rapid and strong and the insects are difficult to follow with the eye on the wing notwithstanding their large size. They rest in dark places during the day in corners of walls, underneath foliage or in large hollows in tree-trunks and sit with their wings tightly closed over the back. In dark places in the jungles and in groves of palms the butterflies keep on the wing later in the morning and appear earlier in the evening. The eggs are laid on the uppersides of leaves and the food-plants of the larvæ are Palms, Plantains and Bamboos, the last for *Matapa aria*, the first for *Gangara thyrsis*, *Paduka lebadea* ; plantains for *Erionota thrax*—belonging to the families *Palmaceæ*, *Gramineæ* and *Scitamineæ*. These larvæ make spiral cells more or less cylindrical in shape in which they eventually pupate, making the first of course small, others to suit their size as they grow. The pupa rattles about violently inside when disturbed or even when the cell is touched ; it is strongly attached by the tail and covered with cereous powder. It is doubtful whether any *Matapa* ever occurs in the Plains or away from jungles and hills. *Erionota thrax* and *acroleuca* as well as *Gangara thyrsis* appear, on the other hand, to be found wherever there are Plantains and Palms. It is therefore thought advisable to include the two *Erionota* in the following descriptions although they are not in the original key.

Genus 20.—MATAPA.

Imago.—Five species, all quite immaculate above and below except for an oblique, glandular streak on the disc below the cell of the fore wing in the male, present in all five. They are all medium-sized insects, chocolate-brown or olive-brown in colour on the upper sides of both wings. *M. aria* (M.) is the only one that comes in here.

Antennæ.—More than half the length of costa of fore wing ; club somewhat thickened with a rather long, pointed crook.

Palpi.—With second joint densely scaled, pressed against face, upturned ; the third concealed.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Vein 12 ends on costa opposite end of cell; discocellulars strongly inwardly-oblique, 5 arising from their junction ; 3 from less than one-sixth before end of cell ; 2 from a little before middle ; lower margin of cell slightly angled at origin of 3 ; the cell rather less than two-thirds length of costa ; costa slightly arched near base, afterwards straight to the slightly produced, sub-acute apex ; outer margin slightly convex, about equal in length to the hinder margin in male but shorter than that margin in female which has a comparatively longer wing.

Hind wing.—Vein 7 from more than one-fourth before end of cell with discocellulars faint, vein 5 obsolete, 3 from very close to lower end and almost touching it, 2 from about one-sixth before end, outer margin evenly rounded except between veins 3 and 1 where it is slightly excised.

Egg, larva, pupa, habits.—See below.

209 Matapa aria (*M.*)—Eyes red : Male. *Upperside* : dark chocolate-brown without any markings except the glandular streak on the fore wing which is straight, grey, edged inwardly with dark-brown ; the costa above the vein is often strongly light-rusty to about half way to apex on the fore wing and there are some brown decumbent hairs at base of wing and a slight fringe of similar ones along inner margin. On the hind wing the whole cell and area behind it including the abdominal fold is set with long brown hairs rather thickly. *Cilia* of both wings very light-yellow tinged with orange at anal angle of hind wing and towards apex. *Underside* : Fore wing dark-brown or ferruginous except the middle portion from the base and including the cell to outer margin whih is blackish-brown, the inner margin below vein 1 much paler. Hind wing uniformly rusty ferruginous of rather a dark shade. Antennæ black obscurely ringed with greyish above, greyish ringed with black beneath; the club with the end bent over at right angles, the bent-over portion yellow below, dull-orange above. Palpi densely scaled with third joint minute, hidden; separated by the coiled proboscis, brown above ferruginous beneath. Head and abdomen above concolourous with the wings, the collar often ferruginous ; thorax and proximal segments of abdomen with long, thick hair ; below more or less concolorous with wings, including the legs.—Female. Like the male but paler and more ochreous-brown, the ferruginous of undersides much brighter ; the abdomen with ochreous tip. Expanse up to 40mm., the female generally the larger.

Egg.—A low dome in *shape* standing upon a flattened, rather broad, irregularly circular ring which is quite transparent and lies on the surface of the leaf or blade, it is in no way ribbed; the egg is as broad at extreme base as it is for some way up. *Surface* slightly shining with about 40 meridional ribs—it is nearly impossible to count them even with a lens as they are extremely fine and low and only exist from the base up about as far as the periphery of the top third—which are white ; the interspaces between them and the top third of the egg are indistinctlv and rather roughly or coarsely shallow-cellular, the moderately large, more or less circular, somewhat flattened space round the invisible micropyle being more minutely cellular still. To the unaided eye the whole surface is smooth but is obscured by a thick covering of the scales from the anal end of the butterfly which adhere to the whole surface irregularly in patches of light fawn and dark brown. *Colour* : Somewhat pinkish, soiled and, later on, with some red-orange spots and marks on the upper part. B. 1·8 mm.; H. 0·9 mm.; the transparent, basal rim about 0·3 mm. in width.

Larva.—The body is more or less circular in transverse section—cylindrical in *shape* that is : but it is, of course, somewhat flattened ventrally and is in this case, swollen laterally in segment 12 so that that segment is the thickest part of the body, or looks it; segment 13 sloped dorsally behind segment 12, is convex transversely and about the same length as segment 14 and little shorter than 12; the anal segment is more or less semi-circular and in the same dorsal slope as segment 13—about 30° or more to the longitudinal axis of body; segment 2 has a moderately broad, shining-black collar from spiracle to spiracle interrupted narrowly dorsally as usual, situated just behind the front margin. *Head* is semi-elliptical in shape, only slightly higher than broad (at base : across mouth-opening) ; the vertex innocent of sinus ; the surface shining and shallowly reticulate rugose; the true clypeus triangular, apex acute, one-third the height of face ; false clypeus slightly outward-curved as to sides, also triangular with apex acute, about half the height of face ; the colour is orange, sometimes with large, black frontal blotch on each lobe reaching from eyes about three-quarters of the way up and conjoined to an apical black blotch on same lobe ; the labrum is transverse and not clearly defined, same colour as rest ; the lingula is white, translucent circular nearly, with a deep triangular sinus, with a few shining, orange hairs at ends of each lobe ; antennal, basal joint is small, sullied, orange, third joint whitish ; mandibles dark red-brown ; eyes black, four in a slight curve, the three lower co-equal, the top one slightly smaller. *Surface* of larva covered with extremely minute, erect, fine, whitish hairs with a subdorsal and dorsolateral, oval, black dot, both widely separated, as also a supraspiracular ditto to each segment ; hairs on segments 13, 14 very much longer and not all of the same length and some somewhat longer hairs (than the short body-hairs) on the dorsoventral margin and legs ; the segment margins impressed—marked thinly with six parallel, well-separated, thin, depressed lines in front of each. *Spiracles* conspicuous jet black very broadly oval, those of segments 2 and 12 twice as large as the rest , none are small. *Colour* of body is greenish chalky-white with the segment-margins and depressed lines looking conspicuously darker ; ventrum and legs all similarly white. L. 25 mm.; B. over 3 mm.

The 12th segment is not so much broader as higher than the rest of the body; although it is strikingly swollen looking.

Pupa.—The pupa is very similar to that of *Gangara thyrsis* in general *shape* but is without the great length of proboscis that distinguishes that species. It has the thorax very humped and by far the highest point of body at its apex, the portion in segment 4, 5 being lowest, segments 6, 7 being again higher than 4, 5 ; the front slope of thorax, segment 2 and the head-vertex are all in one plane at an angle between 45 and 30° to the longitudinal axis of the body, the hinder slope shorter than the anterior one and ending rather abruptly in a sudden short fall to segment 4, the hinder margin a curve rather longer than a quarter-circle and meeting the wing-lines in an open, rounded angle of about 90°; segment 4 sloping down to segment 5 and only slightly shorter than it, segment 6 double the length of 5; *head* as said, with the vertex dorsal, the frons in a plane perpendicular to the longitudinal axis, both lightly convex, the basis of antennæ slightly prominent, the eyes also very prominent so that the head is slightly constricted behind them, and an unusual, small, rounded tubercle at their interior lower margin, just where the proboscis takes its origin; this proboscis produced free to the end of segment 10 but closely applied to the body ; the part of the body from the hinder margin of segment 10 strongly decurved with segment 11 one-quarter as long again as 12 ; segment 13 a short transverse piece forming the posterior slope of segment 12, or rather the posterior part of the slope of that segment, the anal segment consisting of a short, transverse, thicker base from which the semi-circular, rather thin (ventrodorsally) end piece proceeds backwards, this bearing at its apex a short, oblong projection, the projection being broader than long and being set with a lot of short, orange, hooked shafts at the end by which the pupa attaches itself. *Surface* moderately shining more or less smoothly and covered with a cereous excretion all over, at the most, transversely fine-aciculate, the segments of the body are well-marked, segments 10, 11 being especially tumid-looking; the bevilled margins of segments 8-11 short behind and rather long-sloping in front, not in any way particularly modelled as to surface ; a very slightly roughened, orange more or less oval surface on apex of thorax on each side of the dorsal line and central, nearly touching each other—what for ? *Spiracles* of segment 2 oval, flush, colour of pupa nearly ; rest narrow-oval, dull whitish, not large. *Colour* greenish-white, darker on thorax, sometimes honey yellowish on thorax ; the orange, apical, thoracic, transversely long-oval surface of thorax, the little tubercles at anterior, lower margin of eye and two small tubercles on shoulder (not prominent either) all orange. L. 24 mm.; B. 4·5 mm. at middle of body which equals the H there : H of thorax 5·5 mm.

Habits.—The egg, very large for the butterfly, is laid singly on the top of a bamboo-leaf, anywhere on the surface, chiefly about half way up, rarely near the tip ; the bamboos chosen being generally rather small and on the edge of an opening in the forest, a path for example being a favourite situation and the leaf is generally one from three to six feet from the ground in a shady place under the overhead protection of large trees. The little larva eats its way out through the top, making a large hole of egress because of the large head; it does not eat the shell after crawling out of it but walks off, very actively spinning silken steps as it goes, moving the front part of body continuously with the head alternately from one side to the other in the ordinary way used when spinning. Eventually, after wandering about aimlessly to all appearance, it comes to rest at the point where it makes a roomy cell for itself by drawing the edges together from the extreme point backwards. For this purpose, after the first couple of silks have been spun from edge to edge to make a preliminary half-open funnel-shaped cell, it eats away a 4 mm.-broad space from the edge inwards to the midrib and at right angles to the edge and at a distance from the point of anything up to 40mm. It then brings the triangular (more or less) piece of the side thus separated from the main leaf over underneath on to the undersurface of the other side, using the midrib as a hinge and fastens it down all round the edge very firmly by pads and strands of silk; the inside is lined with a silken carpet and in this large cell the little larva passes its first stage or two. It is bright blood-red when it first emerges, about 4mm. long by 0.75 mm. or less in width with an enormous, black, triangular head which is thick, shining, naked and very slightly bilobed on the rather narrow vertex; segment 2 is yellowish with the narrow, transverse, chitinized, black collar of the mature larva already existing; the surface is covered with a few minute, erect hairs and there are some very much larger ones round the anal margin. The little larva—and the big one too, us a matter of fact, behaves in exactly the same way as that of *Gangara thyrsis*; making, just as that one does, a spiral cell eventually which hangs on to the main part of the leaf by a thin thread of blade left for that purpose. The final cell is thickly lined with silk and the larva leaves it only at night-time or in the dusk of the evening or at or just before dawn in the morning to feed—in dull weather feeding time is prolonged. Pupation takes place in this final cell or one like it in which the silken lining or carpet is made much thicker especially in the transverse lines or steps that always exist inside the houses of these species (*Gangara* and *Matapa*); the carpet being thickest at the lower end, *i. e.* the top end really where the head of the pupa is, for the cell hangs down by its supporting thread and the opening, always protected by web spun across, is directed downwards. The pupa is attached strongly to the upper end and hangs head-down and shivers violently when touched producing a loud, rustling noise, exactly in the same manner as does that of *Gangara* although the special adaptation of the proboscis and ventral segments is not present here. The proboscis is closely applied to the ventral segment 9 where there is a depression to receive it but there are no ridges on either surface. The butterfly nearly always emerges towards the small hours of the morning and remains motionless all day until the late afternoon, sometimes taking a preliminary flight after completely hardening.

It is a strong flier, quick and devious, hardly ever flying straight ahead. It is fond of flowers and may be found at them any day in the late afternoons, choosing such as grow close to the ground in very shady places. It often rests on leaves and is easily caught. The wings are held closed over the back and the fore wings do not seem ever to be drawn much into the hinder ones, neither have they ever been observed even slightly opened. This species is very plentiful on the Western Ghats, both above and below, wherever bamboo is found. The larva feeds indifferently on any bamboo—*Bambusa arundinacea, Dendrocalamus strictus, Oxytenanthera* or *Ochlandra Talboti,* Brandis. The habitat of the insect is India, Ceylon, Burma, Andamans, China, Malay Peninsula and Malay Archipelago. Swinhoe says " the types are marked Bengal; we have it in our collection from the Donat Range, Ataran Valley, Ceylon, Hue, Annam, Brunnei, Borneo, the Philippines, Karwar and many examples from the Khasia Hills of both sexes; Elwes records it from Masuri; Fergusson from Travancore; Betham from the Central Provinces; Aitken and Comber from the Konkan; de Nicéville from Calcutta; J. J. Walker from Hongkong; Wood-Mason and de Nicéville from Cachar and the Andamans." It is also found in the Thana District of Bombay and in Kanara, Belgaum, the western parts of Dharwar and all along the Western Ghats.

Genus 21—GENGARA.

There is only a single species, *thyrsis,* (*F.*). This is figured on Plate N, figures 84 and 84a, representing respectively the male and the female. The figures are rather too dark and, in the male, neither the tufts of hair on the front half of the back of the abdomen nor the tufts on the underside of fore wing in the middle of the hinder margin, extending up to vein 1, are at all evident.

Imago.—Very large, up to 75mm. in expanse, or 3″, even occasionally slightly more. Dark glossy-brown on the upperside when fresh, fading with age; the fore wings with three subapical dots and three large, discal ones, all golden-yellow; hind wings immaculate. Underneath it is dark-brown with cloudy powdering of blue-whitish scales on both wings.

Antennæ.—More than half length of costa of fore wing; club gradual, of moderate thickness, the end bent over more or less at a right angle, ending in a fine point.

Palpi.—Upturned, second joint densely clothed, pressed close against the face, reaching just to level of vertex of head; third joint minute, nearly concealed. The palpi are always well-separated by the proboscis.

Hind tibiæ.—Longly fringed and with two pairs of spurs.

Fore wing.—Vein 12 ends on costa before end of cell; cell short and little more than half length of costa, its upper end bent somewhat down; a short internal vein from near base of vein 3; upper discocellular very short, middle and lower strong and in an almost erect, straight line, the lower the shorter; vein 5 therefore nearer to 4 than to 6, strong; 3 about one-sixth from lower end of the cell, 2 from about one-third from base; costa arched at base, then evenly, gently curved to apex; apex blunt, somewhat truncate; wing long ; outer margin nearly straight from tornal angle to the truncation at apex and shorter than inner margin. In the males on the upperside, there is a glandular streak above the middle of vein 1 and a double streak on each side of basal half of vein 2 ; on the underside there is a patch of erectile, yellow hairs extending from middle of inner margin to vein 1.

Hind wing.—Vein 7 from about one-fourth before and of cell ; upper discocellular faint, erect, shorter than lower which is well developed and outwardly oblique ; 3 from just before end of cell, 2 from before middle ; outer margin sinuous and broadly, shallowly lobed towards anal angle. In the males the lower margin of the cell between veins 3 and 2 as well as the basal halves of these veins are considerably swollen ; on the upperside the wing thickly clothed with long hair from its base concealing the swollen veins.

Abdomen.—In the male with thick dorsal tufts of hair on the two or three proximal segments.

210. Gangara thyrsis, (*F.*)—(Pl. N. figs. 84 ♂, 84 ♀).—Male. *Upperside* dark chocolate-brown. Fore wing with semihyaline, gold-ochreous, quadrate spots ; a very large one filling up the cell near extremity, excavated on its outer side ; another, slightly smaller, filling up the middle of interspace 2 and a much smaller one further out in the middle of interspace 3, slightly irregular in shape ; two small spots before middle of interspaces 7, 8 before apex and close together with another further out in middle of interspace 6. Hind wing without markings. *Cilia* of fore wing brown, becoming whitish towards the hinder margin ; of hind wing whitish throughout, but suffused brown in centre. The fore wing is also provided with long hair on the upperside at base extending outwards along inner margin as a fringe, much longer and thicker in the male than in the female. *Underside:* dark-brown, variegated with a clouding of bluish-grey. Fore wing with some whitish scaling in three patches towards apex ; the hinder marginal space broadly whitish under the tuft of yellow hairs; spots showing through from upper side. Hind wing with the whitish scaling in four more or less distinct, parallel bands transversely across the wing, leaving the abdominal fold mostly unmarked. Antennæ black fading to brown, the club and upper part of shaft beneath greyish, the turned-over part dull-orange. The eyes bright red—Female. Like the male but without glandular streaks or sex-tufts ; the dorsal tufts of hair on abdomen also much smaller ; the truncation of apex of fore wing slightly less defined. Expanse of female up to 80 mm ; of male somewhat less.

Egg.—A nearly perfect hemisphere in *shape*, standing on a narrow inclined (outwards) band that is hardly as broad as the distance between two ribs. *Surface* shining, very minutely punctured rough, generally covered with blackish, dust-like, very fine hairs only visible under a lens ; sculptured with 40 very thin, low, indistinct meridional ribs that go on to the basal band, none of these ribs reaching the actual apex of dome. *Colour*: livid white. B : 2.25mm ; H : 1.25mm.

Larva.—Subcylindrical in *shape*, fattest about segment 5 when at rest and slightly hunched; after which the diameter decreases little to the anal end which is still high at 12, sloping afterwards to the broadly-rounded end of segment 14 ; prolegs short : *head* more or less triangular in shape, the face convex, broadest at base, the apex narrowly rounded ; the surface of the head is cellular-rough, the cells flat-bottomed with very thin walls that are also very low ; on the cheeks above the eyes and upwards to vertex there are little tubercular points, longest on lower cheeks but never even then as high as a diameter of one of cells of the roughness ; there are many soft, light-coloured, decumbent hairs all over, all pointing downwards but these are not easily visible ; true clypeus long-triangular twice as high as broad, the sides slightly concave-curved in about the middle, the apex acute with a slight medial ridge from it to base in dorsal line ; false clypeus, if present, not visible; labrum short, lozenge-shaped, transverse, whitish; yellow ligula rather large and circular with the frontal sinus triangular and deep, brown-shining; both antennal joints brown; eyes arranged with the three uppermost, numbers 1, 2, 3, equidistant from each other in a slight curve, number 4 twice as far from 3 as 3 is from 2, number 5 the same distance from 4 and behind it, 6 forming the apex of an equilateral triangle with 4 and 5; colour of head dark-chocolate brown but always covered with a thick coating of white powder which completely conceals the surface. The height of the head is 6mm. and the breadth at base is about 5mm. *Surface* of body slightly haired with short, erect hairs that are longest along the dorsoventral margin; this surface exuding a cereous white secretion all over that forms long threads of a flaky looking consistence that completely hide the surface of the body; this excretion is easily removed by the touch and is not formed if the caterpillar is in bad health; it forms in bunches of threads everywhere except on ventrum and is densest, thickest on segments 3 to 5 and 12 to 14. *Spiracles* not possible to see because of the dense coating of white powder. *Colour* of body rose-brown, even reddish dorsally except on segments 2, 3 where it is sea-green like the ventrum and spiracular region. L: 45mm; B: 7mm at thickest part.

Pupa.—This is rather abnormal in *shape*; the front rather exceptionally humped at thorax and stout, or appearing such because the abdomen is rather elongated; the thorax is quite evenly rounded; the head without protuberances, the dorsal constriction behind thorax slight, the shoulders very slightly convex prominent with the lateral outline behind them as far as 8 very shallowly concave; the *head* is somewhat narrow with prominent eyes, narrowing very slightly backwards; the vertex is inclined at about 45° or less to the longitudinal axis of body, the frons, about as long as vertex, is perpendicular to the axis and rather convex, the convexity somewhat flattened, low; the clypeus is semicircular, the eye-crescent linear; the fore legs reach middle of wings, the mid legs reach three quarters the length of wings; the antennæ are somewhat longer than mid legs and have the clubs prominent and cross-rayed; the proboscis is extremely long, free beyond the ends of wings and there curled into a spiral of one and a half convolutions reaching sometimes, even thus curled, the end of the body, the free portion, if stretched out, sometimes reaching 30mm. in length; the whole proboscis, in one case, reached, measured from base to tip, 47mm; the free portion of this proboscis runs in a groove in the middle of ventrum of segment 9 and on each side of this groove are two transverse, short ridges abutting immediately against the proboscis; a similar arrangement is situated on segment 10; the proboscis-sheath is transversely ridged completely round and very closely throughout the free portion, these ridges being quite sharply prominent where the proboscis passes between the large ridges of the ventrum of abdomen in the groove and, when the body is suddenly bent down, as it is when the pupa is touched, a hissing sound is produced by the arrangement; the proboscis is more or less rigid from end of wings to the end of segment 10, fitting closely into the grooves of 9 and 10 after which it sweeps out into the curve and is much more pliable; segment 12 is also abnormal:—it is as long as 11 and the dorsoventral edge beyond the spiracle is produced outwards and backwards into a strong, conical tooth that really includes segment 13 which is a very short transverse piece in a plane nearly at right angles to the longitudinal axis of pupa; the pupa is as broad at the hinder margin of 12, therefore, because of these teeth, as anywhere else; segment 14 is all cremaster, about as broad as one-third of 13, oblong or slightly oval-truncate, as long as 12+13, down-curved, deep at base coming to an edge at hinder margin, concave dorsally, the concavity bounded by well-defined, sharp edges, the sides perpendicular to dorsal portion; the ventral aspect flat also, the hinder margin somewhat concave, emarginate and set with a bunch of closely-packed hooked shaftlets that are very short and dark-rusty in colour; segment 2 is a transverse piece, straight on both margins, rather longer than the vertex of head with a dorsal inclination to axis of about 40°; thorax about 3 × the length of segment 2, evenly rounded, not very prominently humped, the apex about half way between front and hinder margin (a little nearer the hinder), the hinder slope rather less than the front slope, the hinder margin equilaterally triangular with apex rounded, the sides meeting wings in an angle of about 45°, this angle deep although rather widely rounded; the dorsal outline after thorax and the ventral outline as far as segment 11 are practically straight; the segments are all well marked. *Surface* dull except on head, thorax and wings where it is shining, slightly transverse-aciculate; segment 10 with two thin, brown ridges parallel to each other and to front margin near that margin with another, shorter, near middle of segment; the former two straight dorsally but curving back laterally and then forwards in front of spiracle; segment 11 similarly ridged but without the one in middle of segment; segments 12 and 13 with each a ridge close to front margin; all three segments (10, 11, 12) with hinder margin slightly raised, dirty, wrinkled, segment 13 with it clearly ridged; veins of wings slightly but obscurely prominent. *Spiracles* of segment 2 longly-oval, light-brown; others narrow, three times as long as broad, light-yellow, each about one-sixth of a segment-length. *Colour* soiled light brownish-yellow except on head, thorax and wing which are clear, watery light-green. L: 35 mm; of which cremaster is about 3mm.; B: 8mm. at shoulders, 6 mm. at head, 7·5mm. at middle.

The whole pupa is covered with a thick coating of white, cereous powder that is also spread over the inside of the cell.

Habits.—The egg is laid on the upper surface of a leaf; the little larva, emerging, makes a shelter by turning over a triangular portion from edge of leaf and makes a more or less tubular cell of it, generally at the tip. Later on it uses the whole leaf-breadth and makes a spirally-coiled cylinder inside which it pupates. The pupa is strongly attached by the tail and shakes itself violently up and down as well as sideways when disturbed producing a rattling noise against the cell-surface, augmented by the hollowness of cell, besides hissing as stated above. The vibrations of the "rattling" are very rapid. The larva lies inside the cell with its head turned on its side when at rest; moves sluggishly at all times and grows rather slowly. The butterfly flies very fast and is on the wing at dusk and at the first dawn, visiting flowers busily upon which it settles to suck the juices. It rests in dark places during the bright daylight. The larva feeds upon *Palmaceæ* and has been found on Canes, Cocoanut palms, Fish-tailed palms and others. It exists wherever its food is found. The habitat of the butterfly is India, Ceylon, Burma, the Andamans, Malay Peninsula and the Malay Archipelago. It is a common species everywhere it exists.

In the pictures of this insect in Swinhoe's *Lepidoptera Indica*, vol. X, pl. 735, figs 1, 1a and 1b. there is no sign of any spot on the upperside of fore wing in the middle of inter space 1, whereas, in very many of the specimens bred in the N. Kanara District of the Bombay Presidency, there is such a spot, similar in colour to the others, varying in size from a mere dot to an obliquely-placed oval of 2mm. in length by about half the width, slanting outwards, situated just above and touching vein 1 in the direction of a line passing along the outer margin of the upper large, discal spot and along the inner margin of the lower spot.

The larval cell is made by cutting or eating a piece out of one-half of the leaf from the edge to the midrib and at an angle of 45 degrees to the midrib from above downwards, then in a concave curve outwards to or nearly to a point on the same edge at right angles to the point where the slanting line hits the midrib ; the very edge of the concavity is then brought up against the underside of the leaf by degrees by starting weaving ropes across the corner where the slanting line meets the concave edge, continuing outwards with the effect of bending the leaf until the cell-cylinder has its longitudinal axis at right angles or more to the basal portion of leaf. The lower end of the cylinder is left open, the inside is covered with a thin carpet of web ; until, before changing to the pupa, the larva more or less closes it by spinning more silk-ropes across the entrance ; it also coats the inside with powder. Sometimes, after the cylinder is made, the midrib is nearly gnawed through and the leaf is eaten through all round the cover (so to speak) so that the whole cell hangs just by the midrib which connection occasionally separates with the result that the house falls to the ground.

There is another genus *Erionota* with two species, *thrax,* (L.) and *acroleuca,* (Wood-Mason and de Nicéville) which may be considered to be butterflies of the Plains as they have been found at Kolar (*acroleuca*) and the other in the Dun—this latter being hardly,however, plain country. The genus has much the same characters as *Gangara* but the males have no sexual marks to distinguish them from the females. The larva appears to be similar to that of *Gangara* in that it is white, is covered with a waxy powder and makes a spiral cell. The food of the caterpillar of *thrax* is said to be plantain leaves, the wild or cultivated *Musa,* botanically belonging to the same family, *Scitamineæ,* as the Gingers.

The following is taken direct out of Swinhoe's *Lepidoptera Indica,* vol. X, pp. 157 to 159 :—

Erionota thrax, (*L.*)—Male. *Upperside* : chocolate-brown with an ochreous tint. Fore wing with three large, semihyaline, ochreous spots of which one is semiquadrate with its outer edge excavated, filling up the outer part of cell but not reaching its end ; another, longer, quadrate spot filling up the middle of interspace 2, sometimes with even sides, sometimes one or other or both sides excavated ; much smaller spot of irregular shape before the middle of interspace 2. Hind wing without markings. *Cilia* of both wings grey. *Underside* : pale chocolate-brown, spots of fore wing as above, the inner part of the wing suffused with blackish-brown ; the hind wing generally uniformly coloured, sometimes with some indistinct, brownish suffusion on its inner portion.—Female. Like the male but larger. Antennæ black, the club greyish white on the underside ; head and body above and below and legs concolorous with wings. Expanse up to 80mm.

Larva.—White covered with a waxy powder and has a black, heart-shaped head. It lives in a shelter made of a portion of a rolled-up leaf. To make this shelter it has to cut into the edge of the enormous leaves of the wild or cultivated *Musa* or plantains, to obtain a suitable segment to be rolled up.

Pupa.—Whitish, covered with the same white powder as is the larva and is hidden from view in its dining-room. The powder is of the greatest service to the animal as, in consequence of the heavy showers of rain of the Tropics, much water often collects in the rolled up leaf and the pupa, if not so protected, would soon be drowned and rot; as it is the powder keeps the pupa dry until the water has dried away or dried up.

The butterfly emerges from the pupa in the afternoon at 2 or 3 p.m. and is on the wing before sunrise or after sunset (de Nicéville and Martin).

Habitat.—India, Burma, Malay Peninsula, Java, Sumatra, Borneo, Hongkong.

Distribution.—A species widely spread all over India; we have it from many parts; it does not appear to occur in Ceylon or the Andaman or Nicobar Islands.

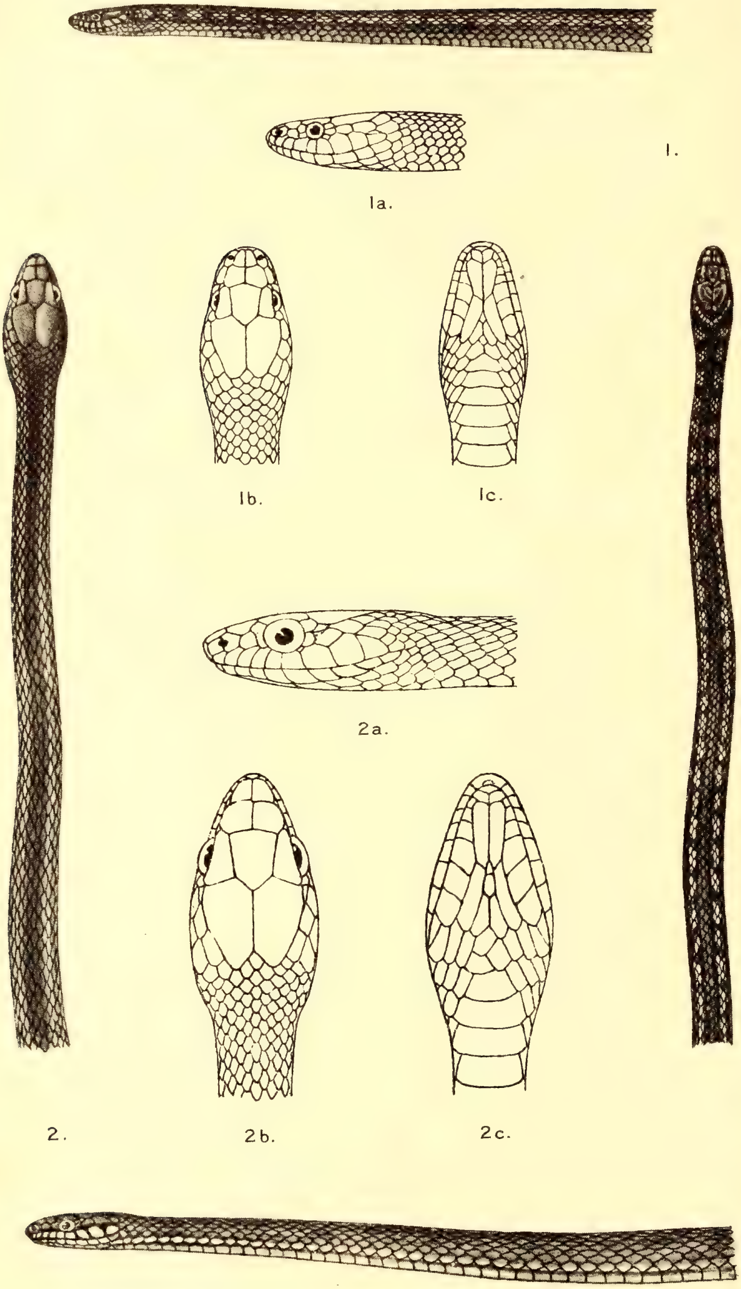
As yet it has not been obtained in the Bombay Presidency.

Erionota acroleuca (*W.-M. & de N.*).—Male. *Upperside* dark-brown somewhat olive-brown of an entirely different shade of colour to that of *thrax.* Fore wing with apex pale, generally ashy-white; spotting similarly to *thrax.* Hind wing without markings. *Cilia* dusky at apex of fore wing, gradually becoming pale-yellow towards the hinder margin and all pale-yellow on the hind wing. *Underside* very little paler than on the upperside, purple-tinted in parts, making the surface somewhat variegated ; markings as in *thrax.* Antennæ black, club on the underside pure-white, the terminal crook red beneath; palpi, head and body above and below and legs concolorous with wings. Eyes red. Female-like the male, the spots larger. Expanse up to 60mm.

Habitat.—Sikkim, Assam, Andamans, Nicobars, S. India.

Distribution.—The types from the Andamans are in the Indian Museum, Calcutta. We have it from the Khasia Hills and from Kolar, South India. The type of *larva* came from the Nicobars; de Nicéville records it from Sikkim.

(*To be continued.*)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1, Natrix nigriventer. 2, Natrix gilhodesi.

TWO NEW BURMESE SNAKES.

BY

F. WALL, C.M.G., K.H.S., COLONEL, I.M.S.

(*With a Plate.*)

In a small collection of snakes sent to me from Huton, Bhamo District (30 miles north-east of Bhamo ; circa 4,500 feet ; Lat. circa 97° ·33 ; Long. circa 24°·24), I find two species that are new to Science. I propose to call one of these after the Revd. Father Gilhodes, to whom my thanks are due for the specimens, all of which were collected in June 1924.

Natrix gilhodesi spec. nov.

No less than six specimens of this well defined species came to hand. That selected as the type may be described as follows.

Length— ♂ 518 mm. (1 foot 8½ inches) ; tail 175 mm. (7 inches).

Lepidosis—Rostral : Depth about three-fourths its breadth ; hardly visible from above; the rostro-internasal, and rostro-nasal sutures subequal, and longer than the rostro-labials. *Internasals* : Two ; truncate anteriorly ; the suture between them slightly less than that between the praefrontals. *Praefrontals*; Two ; the suture between them hardly half the length of the frontal. *Supraoculars* : Length rather less than the praefrontal and internasal taken together, three-fifths the parietals. Breadth about two-fifths the frontal along a line connecting the centres of the eyes. *Frontal* : Length rather greater than its distance to the end of the snout, two-thirds the parietals. *Nasals* : Divided. *Loreal* : Three-fifths the length of the nasals. *Praeocular* : One. *Postoculars :* Three. *Temporals :* 2+1+2. (In all other specimens 1+1+2.) *Supralabials* : 9 ; the 1st and 2nd touching the nasals ; 4th, 5th and 6th the eye ; 7th and 8th the anterior temporal. *Infralabials* : 7 ; the 5th, 6th and 7th touching the posterior sublinguals. 7th about three-fifths the length of, and rather broader than the posterior sublinguals. *Sublinguals* : Two pairs ; the posterior rather the longer and separated by 1+1+2 scales, succeeded by a narrow 1st ventral. *Costals* : In 19 rows two heads-lengths behind the head, 19 at midbody, 17 two heads-lengths before the vent. The reduction of rows from 19 to 17 takes place about three or four heads-lengths behind midbody, and is due to the fusion of the 3rd and 4th rows above the ventrals. Keeled to the penultimate row at midbody. Slightly emarginate apically. No lateral facets. Vertebrals. Breadth about two-thirds their length, three-fifths the ultimate row. Ultimate row. Breadth about two-thirds their length. *Ventrals* : 157. *Anal* : Divided. *Subcaudals* : 110, divided.

Colouration—Dorsally dark brown, with an ill-defined, reddish stripe on the 5th and 6th rows above the ventrals where the rows are 19, and on the 4th and 5th where 17. This begins near the neck and ends at the vent. Ventrally whitish, the edges of the ventrals brown as on dorsum. Top of head dark brown leaving an interrupted white moustachial stripe., which is continued interruptedly to the side of the neck. In general appearance it reminds me forcibly of *Natrix khasiensis.*

Dentition—Maxillary 26, anododont, syncranterian, coryphodont ; the last three teeth distinctly enlarged and subequal. *Palatine* : 15 on left side 16 on right ; anododont, isodont. *Pterygoid* : 27 left, 15 right ; anododont feebly kumatodont. *Mandibular* : 30 on left side, 29 right ; anododont, feebly kumatodont.

Remarks.—The other five specimens agree except in the following points :— The ventrals vary from 147 to 157, and the subcaudals from 97 to 110. In all the temporals are 1+1+2. In one specimen there are dubiously two praeoculars. One has only two postoculars on both sides and another on one side only. The 4th and 5th supralabials are confluent in one example, making the total 8, of which the 4th and 5th only touch the eye.

The greatest length is that of a ♀ *viz.* 530 mm. (1 foot 9 inches) ; the tail 17 mm. (7 inches). The colour in one has a marked ruddy tinge dorsally. One measuring 478 mm. (1 foot 6⅞ inches) was egg-bound, and contained one elongate egg 31 × 6 mm. (1¼ × ¼ of an inch).

Natrix (?) *nigriventer* spec. nov.

This species is represented by a single specimen which is probably juvenile. Being unique and small I have preferred not to risk damage to it by an investigation of the maxillary teeth; but place it provisionally in the genus *Natrix*. It was captured in June 1924 at Huton, Bhamo Dist. *Length.* 318 mm. (12½ inches); tail 112 mm. (4 inches).

Lepidosis.—Rostral : Depth about three-fifths its breadth ; hardly visible from above ; the rostro-nasal and rostro-labial sutures equal, and rather greater than the rostro-internasals. *Internasals* : Two ; truncate anteriorly. The suture between them equal to that between the praefrontals. *Praefrontals* : Two. *Supraoculars* : Length a shade less than the praefrontals and internasals taken together, rather less than the frontal, three-fifths the parietals. Breadth about two-fifths the frontal along a line connecting the centres of the eyes. *Frontal* : A little longer than its distance to the end of the snout, two-thirds the parietals. *Nasals* : Divided. *Loreal* : About three-fourths the length of the nasals. *Praeoculars* : Two. *Postoculars* : Three. *Temporals* : 1+1+2. *Supralabials.* 9; the 1st and 2nd touching the nasals; 4th, 5th and 6th the eye ; 7th and 8th the anterior temporal. *Infralabials*: 7 on the right side; 8 on the left, the last about half as long and about as broad as the posterior sublinguals. *Sublinguals:* The posterior pair rather longer than the anterior, and in contact with the 5th, 6th and 7th on the right side, the 6th, 7th and 8th on the left. Entirely separated by 1+3 small scales which are succeeded by a pair before the 1st ventral. *Costals:* In 17 rows in the whole body length; keeled to penultimate row at midbody ; emarginate apically ; with no.(?) lateral facets. Vertebrals. About three-fifths their length, three-fifths the breadth of the ultimate row. Ultimate row. Breadth of scales subequal to their length. *Ventrals* : 157. *Anal* : Divided. *Subcaudals* : 127. Divided. *Colouration* : Dorsally blackish-brown. A dull ochraceous stripe on the 5th row above the ventrals, interrupted to form a macular chain in the neck and forebody, and continuing on to the base of the tail. A largish, ochraceous spot behind the 9th supralabial not meeting its fellow over the nape. Ventrally uniform blackish-brown with throat and chin dirty yellowish mesially. Head blackish above with obscure lighter vermiculations. Upper and lower labials with blackish posterior margins. A dull ochraceous oblique streak on the posterior temporal, and upper half of last labial.

NOTES ON CHAROPHYTES FROM GONDA, U. P.

BY

G. O. ALLEN, I.C.S.

(*With 5 plates.*)

With such a brief acquaintance with this group of plants I have only ventured to publish these notes in the Journal from the fact that nothing of the sort has previously appeared therein. The occasion may perhaps be opportune owing to the recent publication by Mr. James Groves, F.L.S., the well known expert on this group, of a paper " Notes on Indian Charophyta " in the Linnean Society's Journal (Botany vol. xlvi, April 1924). This will be of the greatest value to any who have studied these plants at all out here and will no doubt stimulate fresh interest in them. The key to the Indian species will also prove of much assistance, particularly in a country where botanical literature is often not readily available.

In the Introduction to "British Charophyta" by Groves and Bullock-Webster there is a remark that " it may be safely conjectured that the majority of well informed people are not even aware of their existence." If this is the case in England it applies with still greater force, I imagine, to India where comparatively few have any out-door tastes other than games and sport. It will be obvious that the following notes are meant as an elementary introduction for those who are more or less unacquainted with the subject and as a record of a few personal observations.

It will be as well to commence by touching briefly on the general features of these plants, generalisations being meant to apply to species found in India. They comprise a small group of cryptogams of entirely aquatic habits and can be fairly easily recognised at sight by their green colour (though this is sometimes rather obscured by incrustation of lime) and the whorled arrangement of the branchlets. Their structure is so unique as to separate them off clearly from all other groups of plants and botanists have now elevated them, though so inferior numerically, to equal rank along with the four great divisions of the vegetable kingdom.

Beautiful as many of these plants are to the naked eye it is not until they are seen under the microscope as well that their full charms are revealed. It is this combination of field work with plenty of scope for examination at home that makes their study so attractive. Judging from the paucity of published records these plants seem to have attracted singularly little attention as yet from botanists in India with the result that there is a wide field for interesting " finds ". Of several recorded species further material is badly needed for expert examination. The total number of species recorded in the world is estimated to be not much over 200. This neglect in India may doubtless be partly attributed to their having, so far as I am aware, no economic value as yet and partly also to the scarcity of literature on the subject (most of which is unfortunately in German) and the consequent difficulty in identifying the different species. The work referred to above, British Charophyta, (by the Ray Society) will be found extremely useful even for Indian workers, the Introduction being particularly instructive. It also contains a full glossary of terms used in connection with this group. I may mention here that I shall be glad to receive specimens from any locality and send others in exchange and at the same time render any little assistance that I can.

Among the most striking characteristics of this group are the simplicity of their general structure and the large size of their cells, which incidentally show cyclosis extremely well, combined with the extremely complicated structure of the reproductive organs. It is this latter peculiarity which is the main ground for their separation from the Algae,the division to which they are otherwise most allied. A remarkable fact about the oogonium (the female organ) differing as it does from that of any other plant is that it has persisted in its present form from at least Oolitic, if not Carboniferous times. Owing to the affinity of these plants for lime numerous fossil fruits and also parts of stems of various species of *Chara* and also of a *Nitella* have been found in a wonderfully good state of preservation, considering the frail nature of the plant in the living state. The study of fossil Charophytes is only in its infancy. Use has been made of them for zonal work.

Charophytes are partial to still or very slowly running clean and usually shallow water. They are always entirely submerged except where by accident they may find themselves in a rapidly drying pool but they do not flourish out of their element. Where they occur they often form the chief feature of the aquatic vegetation of the spot. They are partial to sunlight. The Charas in particular often grow in great dense masses. Charophytes however are not adapted to put up much of a fight against more aggressive types of water plants though the incrustation of lime which is a common feature in some genera is considered to be an effort on the part of the plant to strengthen its position in life. The large shallow open jhils of Northern India appear to be well adapted to the needs of these plants while flooded rice fields appear particularly favourable surroundings for the smaller species. The more vigorous growers often suffer from overcrowding, finer specimens being obtained where the plants have more room to spread themselves.

A few hints on collecting may not be out of place, Charophytes prefer to grow as a rule in soft mud. Wading is the best means of gathering them, a method often quite feasible in Indian waters. Where the water is deep the grapple and line may have to be resorted to but this is apt to cause much damage to the material collected and entails much patience in disentangling the frailer species. Good specimens in fruit should be carefully selected and dug up entire by hand. They should then be washed gently in order to remove the larger portions of extraneous attachments, the fine mud from the rooting portion being easily separated by gentle hand pressure while the plant is floating in the water. They should not be jumbled up anyhow but the more delicate kinds brought home in glass tubes filled with water and the larger ones either in an earthenware pot with a large mouth or in a vasculum of the ordinary type. In the hot weather they shrivel up extremely quickly if not kept in water. The assistance of a companion often comes in handy for carrying the pot as both hands are generally wanted for the preliminary process of cleaning and gathering and when wading there is nowhere to put anything down. The importance of obtaining some ripe fruit cannot be insisted on too strongly as it is sometimes practically impossible to determine a species with any certainty without an examination under the microscope of the ripe oospore the membrane of which often bears a characteristic design. In the case of diœcious species specimens of both sexes should of course be taken. On getting home it is as well to go through ones gatherings carefully as a delicate species whose presence is unsuspected may sometimes lurk among the stouter kinds.

Specimens which it is desired to mount dry should be dealt with as soon as possible. The gathering should be placed in a white basin and the selected portions there freed as far as possible from Algae and other forms of "rubbish." The very robust species can then be arranged on mounting paper and the surplus water allowed to drain off. It is not always desirable to separate each stem, often a most tedious task : a loose clump arranged in as natural a position as possible generally best illustrates the manner of growth. They should be covered with a piece of clean linen or calico to prevent the plant adhering to the drying paper. A few sheets of newspaper serve the purpose of drying paper

Fig. 1.

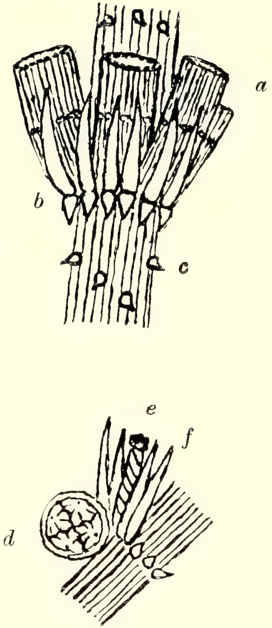


Fig. 2.

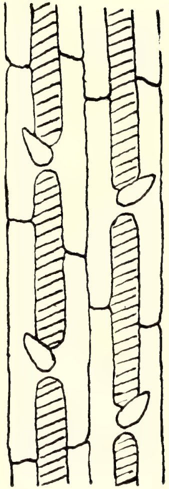


Fig. 3.

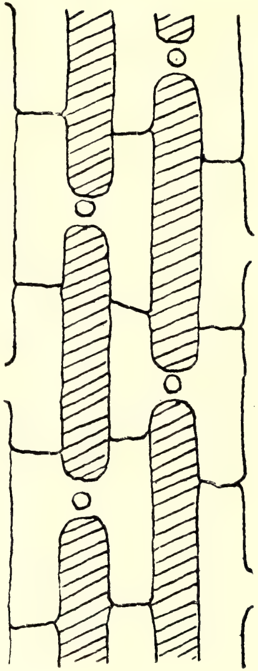


Fig. 1. *Chara brachypus*—*a.* branchlet ; *b.* stipulode ; *c.* spine ; *d.* antheridium ; *e.* young oogonium ; *f.* bract cell. (Note.—***Lowest branchlet*** *segment very short ; a characteristic feature of this species*).

Fig. 2. *Triplostichous* stem-cortex—Primary series bearing spines shown shaded.

Fig. 3. *Diplostichous* stem-cortex—Primary series bearing nodes (no spines shown) indicated by shading.

extremely well. Some weight should be placed on the plants according to the nature of their build. Some of the stouter Charas require very considerable pressure, the delicate Nitellas only a little. The secret of success is to remove the linen at latest the next day. The old newspaper is then replaced by dry pieces, the plant being left as it is on the white paper mount. Even with the robust forms a little manipulation with the needle either before pressing or an hour or two later when the plants are half dry will often improve the arrangement but in the majority of cases and especially with the delicate forms such as Nitellas a different procedure has to be adopted. After being cleaned in the same way the specimens must be floated on to the mounting sheet which should be supported on a sheet of perforated zinc, a most valuable aid in getting the plants to assume a natural position. A small oblong zinc tank with sloping sides about three inches high and just large enough to enable the perforated zinc to be easily removed considerably adds to ones comfort. The water should not be deeper than is really necessary. This process is occasionally rather a tedious task but the beautiful results that mayoften be obtained in this way fully repay the trouble bestowed. The rest of the procedure is the same as already described.

A few Nitellas have a mucilaginous jelly-like coating over them, particularly over the younger shoots and even the Charas sometimes have sticky globules of Algae firmly adhering to them. In such cases a piece of oil cloth must be substituted for the linen. This jelly coating presumably serves to protect the young parts and reproductive organs in some way. When one comes to mount for example a specimen of *N. hyalina* one finds it a mass of particles of dirt which it is very difficult to detach.

After the drying is completed with several changes of newspaper the plants can be secured to the mounting sheet by little pieces of transparent gummed paper. Nitellas are often sufficiently fastened by the pressure during drying and require nothing further. A safer method, though it takes much more time, is to paint over the plant with gum and then turn the whole sheet over on top of the final mounting paper and detach the original sheet, damping the back of the latter in places if found necessary for its removal. I have not personally tried this method but beautiful mounts are thus obtainable and unless very carefully stored and handled specimens only fastened with gummed paper are likely to get damaged. Each sheet should have a label attached and a number assigned for each separate gathering.

What is not required for mounting dry can either be grown in glass jars for purposes of observation or to obtain ripe fruit or if already in this condition some may be kept in tubes of weak formalin for mounting portions as microscopical slides or as a reserve for distributing or exchanging specimens. Immature specimens as well should be mounted dry and some kept in fluid.

Lime incrustation sometimes assumes a curious form. In some Charophytes especially Nitellas and the ecorticate Charas, though I have found it also in *C. zeylanica* a corticate species, the incrustation is annular. This takes somewhat different forms : in some the bands are wide, in others mere rings.

Ordinarily a 2 per cent. solution of formalin is quite strong enough for preserving Charophytes satisfactorily. This is readily made by mixing one part of the usual 40 per cent. formalin with 19 parts of water.

In mounting for the miscroscope it will often be necessary to soak the selected portion for a few minutes in dilute nitric or hydrochloric acid to remove the lime. This destroys of course the beautiful green colour of the plant but it is often impossible to make anything of the structure without the specimen being subjected to this process. After the acid has been washed away with water the specimen must be carefully cleaned with a camel's hair brush to remove the Algae and multifarious small animals that often infest these plants. When the portion being mounted has ripe fruit on it the greatest care has to be taken not to dislodge it as the ripe oogonia are only loosely attached at this stage. Plants in this condition are frequently very dirty but it is often better not to attempt too much cleaning rather than risk spoiling the specimen. Very delicate attention with a fine brush and the needle is all that can be done. (It is desirable of course to mount specimens in different stages : for it is often much easier to make out the structure with young shoots.) The specimen can then be mounted straight away in formalin or more satisfactorily in dilute or pure glycerine. A mixture of equal parts of glycerine and water is often employed. With the more delicate species much care has to be exercised in adding the glycerine to avoid the cells collapsing. This is a matter of experience. It is safer as a rule to let the object soak for twenty-four hours at a time in successively stronger solutions of glycerine. This may be effected by mounting in formation and putting a drop or two of glycerine on the slip on either side and leaving it to find its way gradually under the cover glass : when this soaks in as the formalin dries up more glycerine can be added in the same way. A mixture of one part rectified spirit, two glycerine and three water often works well as a start. The mounts can then be sealed in the usual way with gold size, either a built up cell being employed or in the case of stout specimens vulcanite or rubber ones. It is not of course necessary to seal up the mounts if they are not likely to be constantly removed from place to place. The specimens may be simply kept soaked in glycerine with a cover glass lightly placed on top. This enables them to be freely examined at any time though dust cannot be easily removed from the cover glass.

Before commencing to describe the different parts of a charophyte I insert here a simple guide to the genera found in India as reference will be made to it in what follows:

NITELLEÆ—Coronula of ten cells in two tiers ; branchlets usually furcate : ecorticate.

1. *Nitella*—Antheridia apical in the furcations (several species).
2. *Tolypella*—Antheridia lateral at branchlet nodes (three species).

CHAREÆ—Coronula of five cells in one tier.

3. *Nitellopsis*—No stipulodes : branchlets of two or three very long segments : very long bract cells (one or two to the branchlet) : ecorticate : (one species).
4. *Lychnothamnus*—Long stipulodes : stem corticate, branchlets ecorticate : gametangia side by side, one oogonium between two antheridia : (one species).
5. *Chara*—Stipulodes always present, sometimes rudimentary : branchlet, never furcate : stem and branchlets either corticate or ecorticates oogonium above the antheridium : (many species).

It will be seen from the above that Charophytes are divided into two families the *Nitelleæ* and the *Chareæ* which are distinguished by the nature of the coronula (a little structure crowning the oogonium) though the two chief genera, *Nitella* and *Chara*, will be readily recognised by other characteristics. The other three genera differ so markedly from *Nitella* and *Chara* that it will be as well for the most part to describe them separately. Up to the present sixteen species of *Nitella* have been recorded from India, fifteen of *Chara* and three of *Tolypella* while the other two genera comprise but one species each.

The most important parts of the plant to be studied, under the microscope in particular, are the stem, the branches, the stipulodes, the branchlets and the reproductive organs.

BRANCHES.

There will be no difficulty in recognising the fact that the stem consists of nodes and internodes. At the nodes are produced the branches, usually one at a node in *Chara*, two in *Nitella* and several in *Tolypella* : they resemble the stem and are of unlimited growth. It is at the nodes also that the whorls of branchlets are given off and at the base of these latter the stipulodes if present are found. The reproductive organs are borne on the branchlets.

STIPULODES.

The stipulodes may be considered first. They are one celled organs, varying much in size from mere rudiments to a substantial length, though always much shorter than the branchlets, and form a single or double circle which will easily be made out under the microscope. It is important to note that stipulodes are only found in *Lychnothamnus barbatus* and all species of the genus Chara. It will be seen that for the purposes of classification the primary division of this genus is into those species with one and those with two circles of stipulodes. Where there is a double row the upper one points upwards and the lower one downwards. Normally the number of stipulodes where the circle consists of two rows is in each row double the number of branchlets while if there is only a single row the number may be the same as or double the number of branchlets. It may not be always easy at first to make out the number but for purposes of identification it is ordinarily sufficient simply to determine whether the row is a double or a single one. (See plate I Fig. 1.)

STEM.

In treating of the stem we come to one of the most characteristic features of a charophyte, namely the cortex. This calls for close study as much of the classification of the genus *Chara* is based on it and the details of structure are some what difficult to make out at first. It occurs in the branchlet as well but I am only referring just now to the stem cortex. A stem cortex is found in *Lychnothamnus* and all the species of *Chara* (except the three largest in which the stem and branchlets are entirely ecorticate).

The cortex is a sheath of cells covering the internodes of the stem. This sheath consists of a number of longitudinal rows of cells lying alongside one another and normally entirely hiding the original stem thus giving it a regularly striped appearance. These rows of cortical cells are produced in a remarkable manner. At each stem whorl two circles of cortex cells start growing one upwards and the other downwards, the cortex of each internode being therefore the joint production of cells which starting from the nodes immediately above and below grow in opposite directions till they meet about the middle of the internode. The primary rows (figs. 2 and 3) of cortical cells themselves consist of alternating nodes and internodes. These internodes go on increasing in length while the nodes do not. The latter however increase laterally (it is this structure that calls for careful examination) but these outgrowths on either side of the node become at once elongated and take their place alongside the original row (the primary cortical series) to form the secondary cortical series. If the species under observation be one that bears spines the primary series will be at once distinguished as the spines are produced at the cortex nodes which as already stated occur in the primary series only.

These secondary cells vary in length in different species. Where they are about the same length as the internodes of the primary series it follows that they occupy the whole of the rows immediately on either side of the primary row and consequently between any pair of adjacent primary rows there will be two rows of secondary cells, one arising from each of the respective primary rows. This kind of cortex is called Triplostichous because for every branchlet there are three rows of cortical cells, the centre one being the primary row and the two others, one on either side of it, the secondary rows. This may sound rather complicated but a reference to the diagrammatic figure (see Plate I fig. 2) will I hope, help to make the structure clear.

In another type of stem cortex the secondary cells are only about half the length of the internodes of the primary row and hence there is room for the secondary cells to accommodate themselves in one row between two primary rows, this one secondary row being built up of cells arising partly from the primary row on one side of it and partly from the primary row on the other side of it. This kind of cortex is called Diplostichous since for every branchlet there are two rows of corticate cells, one primary and one secondary. This type is easier to make out than the former one as there is more space round the stem for the rows which are consequently rather wider. (see Plate 1 fig. 3.)

So long as the ends of these secondary cells are squarish they fit on top of one another like stones in a column and recognising whether the cortex is triplostichous or diplostichous presents no serious difficulties. An intermediate arrangement however occurs when the ends of the secondary cells taper and overlap the ones above and below them. Under these circumstances a transverse section of the stem would sometimes show two secondary rows and sometimes only one between an adjacent pair of primary rows. This condition is known as sub-triplostichous. It is not very common but judging from my own experience it is the most difficult to make out. In one species of *Chara,—C. canescens,* recorded from Quetta there is no secondary cortex : the same applies to *Lychnothamnus barbatus.* The cortex is then known as Haplostichous. This is of course the easiest type of all to distinguish. Usually the cortical cells are contiguous : in *L. barbatus* there are spaces between them.

In examining the structure of the cortex cutting transverse sections will afford both interest and assistance, particularly in determining the relative sizes of the cells in the two series. In some species they are of equal size : in others either may be the larger. This question of relative size is of importance for purposes of classification. If the primary cells are the more prominent (they may be distinguished as stated above by the spines if they happen to be present or by the nodes) the condition is known as Tylacanthous the spines appearing to be situated on ridges. If the reverse, it is called Aulacanthous the spines appearing to lie in furrows. It is not always easy by any means to make out the relative size of these cells of the two series from every portion of the stem. The specimen has often to be searched under the microscope until a suitable portion is found that will settle the point. A young portion of the stem shows this best.

The stem of a Charophyte is often subject to torsion : the cortex where present follows the twist of the stem, which always ascends from left to right and thus in the opposite direction to the spiral in the oogonium. Spines are a second form of outgrowth from the cortical cell nodes. They vary considerably in size and generelly single. Those arising nearest the stem nodes are usually larger and tend to point towards the middle of the internode *i.e.,* those on the descending cortex point downwards and those on the ascending upwards. As a rule stipulodes spines and bract cells in any species agree in being well developed or otherwise. A remarkable exception is N. obtusa which has extremely long single bracts but no stipulodes and naturally no spines, the stem being ecorticate.

In this connection a passing reference may be made to the rooting system. When the oospore begins to germinate there are formed the pro-embryo from the node of which the stem starts and the primary root. The latter elongates and forms nodes at which rhizoids are produced. Rhizoids are also formed at the lowest nodes of the stem. The rooting part of the plant appears white as it contains no chlorophyll. Its only purpose is to attach the plant to the mud.

Bulbils may also be briefly noticed. They are reserves of starch formed at the lower stem nodes and root nodes. They consist as a rule of a large spherical cell proceeding from a root node only or a roundish mass of small cells at the stem nodes. They have only been recorded in the case of a few species but may often have been overlooked. Personally I have only noticed stem bulbils *viz.,* on *C. zeylanica.*

BRANCHLETS.

Branchlets as already mentioned arise at the stem nodes in whorls and are one of the most obvious features of a Charophyte. The branchlets it will be remembered bear the reproductive organs. In the *Nitelleæ* and in *Nitellopsis* the number is usually six while in the rest it varies from seven to sixteen. All the branchlets in any whorl are as a rule similar (the genus *Tolypella* and *N. hyalina* form exceptions). In the older parts of the plant they decay just as the leaves of a land plant do. In the youngest parts they tend to curve inwards or be closely addressed to the stem whilst as they grow they open out, the ends pointing upwards though not necessarily in a stiff and regular manner. It will be sufficient to pay particular attention at first to the differences between the branchlets in the genera *Chara* and *Nitella. Nitellopsis* and the species of *Tolypella* present considerable modifications and the first finds are more likely to consist of a *Chara* or a *Nitella.*

The branchlet in *Chara* (as also incidentally in *L. barbatus*) consists of three or more nodes and internodes after the manner of the stem though the growth is in this case limited and at each node there is a whorl of one-celled bract cells. These latter are usually shorter on the outer side of the branchlet and vary a good deal in shape and size in the different species.

In *Nitella* the antheridium or male reproductive organ is terminally situated instead of laterally as in *Chara* with the result that at the node a furcation into two or more lateral members occurs, though it by no means follows that there is always an antheridium at every furcation. These lateral members may furcate again at their nodes and further lateral members be formed. An original branchlet may thus divide up into a number of forks. This furcation is characteristic of a *Nitella* and will at once serve to distinguish it from a *Chara* and all other genera. A pine tree with its branchlets and tufts of slender needles and dotted about with cones sometimes reminds me of a gigantic *Nitella.* The ultimate rays of the final furcation are called dactyls. These dactyls may be one celled (as in *N. acuminata* and *N. mirabilis*) or more usually two celled or occasionally three.

The nature of the furcation is of importance for purposes of classification. Species differ in the number of furcations, in the number of rays given off at these points and in the nodes where reproductive organs are found as well as in the shape and structure of the dactyls. The branchlets at each stem whorl are similar in every species except *N. hyalina* which may be at once identified by there being two different kinds, a long and a short (actually arranged in one circle of long branchlets and two of short). In *Nitellopsis* the branchlet has generally only one node and instead of a whorl of short bract cells there are produced one or two long though still one celled bract cells on the inner side of the branchlet.

In *Tolypella* there are sterile branchlets as well. These are simple *i.e.,* no furcations of any kind. The fertile branchlets consist of one or two cells followed by a node and then by several elongated cells. At the node of the branchlet instead of one celled bracts being produced there occur members made up of a string of cells. This all makes the branchlet of *Tolypella* a more complicated affair.

BRANCHLET CORTEX.

In nearly all the species of Chara the branchlets are also corticate though the cortex is simpler than that of the stem. There is no division into primary and secondary cortex and there are no cortical nodes and internodes or spines, The branchlet cortex is formed in the same way as the stem cortex *i.e.*, a ring of cells starts from one node and grows downwards to meet a similar ring growing upwards from the node below. These rings meet more or less evenly in the middle of the internode. Generally there are two cortical cells to each bract cell with the result that the bract cell lies opposite the dividing line between two cortical cells. In some Indian species the branchlet cortex is triplostichous *i.e.*, three cortical cells to each bract which is consequently opposite the middle one of the three. In a very few Indian species the lowest branchlet segment is ecorticate and in some cases the branchlets are entirely ecorticate although the stem has a cortex. In the younger parts of a plant it sometimes happens that the segments towards the free end of the branchlet have no cortex. This is often the case with *C. contraria*, a feature which is regarded as rather characteristic of the plant.

Reproductive Organs.

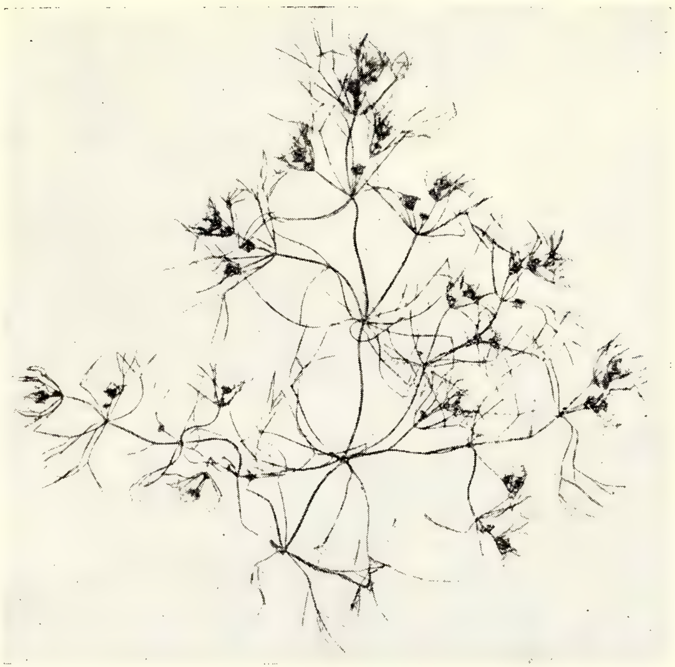
We now come to the remarkable reproductive organs, the antheridium and oogonium. These are situated on the branchlets at the nodes and sometimes also at the base of the branchlet. Their actual position differs in the various genera. In *Nitella* the antheridium is solitary (Except in *N. mirabilis* where they are in clusters) and situated terminally at the end of a branchlet ray and the oogonia are laterally placed at the same spot but below the antheridium. In one species, *N. mirabilis*, which is dioecious, the reproductive organs are both stalked. In *Tolypella* the antheridium is also solitary but both it and the oogonium are laterally placed. The organs being rather crowded it is not always easy to see how they lie in this genus. In *Chara* the antheridium and oogonium are placed together laterally on the inside of the branchlet, the former below the latter. The antheridium is a very remarkable organ. It is spherical in shape and the outside consists of eight convex shields with much indented margins which fit into those of the adjoining shields. At the centre of the inner surface of each shield there is an elongated cell like a handle that is directed towards the centre of the antheridium. This is styled the manubrium. At the free end of it are attached a large number of filaments which contain antherozoids. If an antheridium be crushed on the microscope stage these filaments will easily be discerned in any number and the beautifully marked shields will be also more clearly displayed. These antheridia are very conspicuous objects to the naked eye being brightly coloured in orange or red.

The oogonium is also a wonderful and beautiful object. It consists of an inner oosphere surrounded by an envelope of five elongated cells. These cells are more or less straight in the early stages but soon become spiral always ascending from right to left. At the top of the envelope a little crown aptly termed the coronula is formed. In *Nitella* and *Tolypella* this coronula consists of a double tier, each tier composed of five cells. In all the other genera there is a single tier of five cells. This forms a distinguishing mark between the two main divisions of Charophytes.

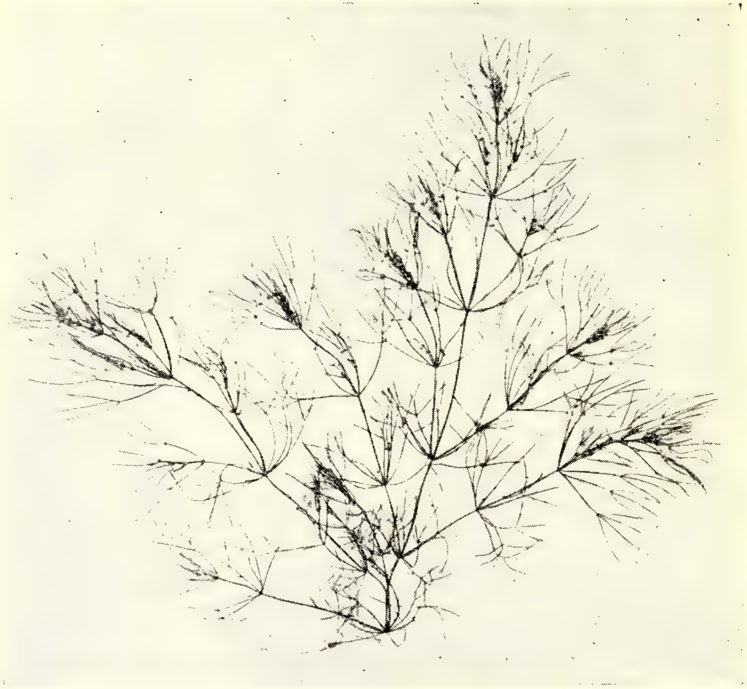
As the oogonium ripens it becomes sperical or ovoid in shape and the oosphere turns as a rule reddish brown or black in colour. After fertilisation which is effected through an opening at, or near the top, of the oogonium the oosphere becomes an oospore and the enveloping cells disappear except along their lines of union which thus form a series of spiral ridges. The oospore is full of starch and fat granules. Surrounding it are a number of thin membranes, some coloured some colourless. The outer coloured membrane generally has some kind of decoration on it which often serves as a useful guide in distinguishing different species. Most Charophytes are monœcious though a few are diœcious.

I come at last to the particular title of this paper. Gonda is the headquarters of the district of that name and is about seventy miles N. E. of Lucknow *i.e.*, in

CHAROPHYTES FROM GONDA DISTRICT, U. P.



Nitella acuminata Braun.

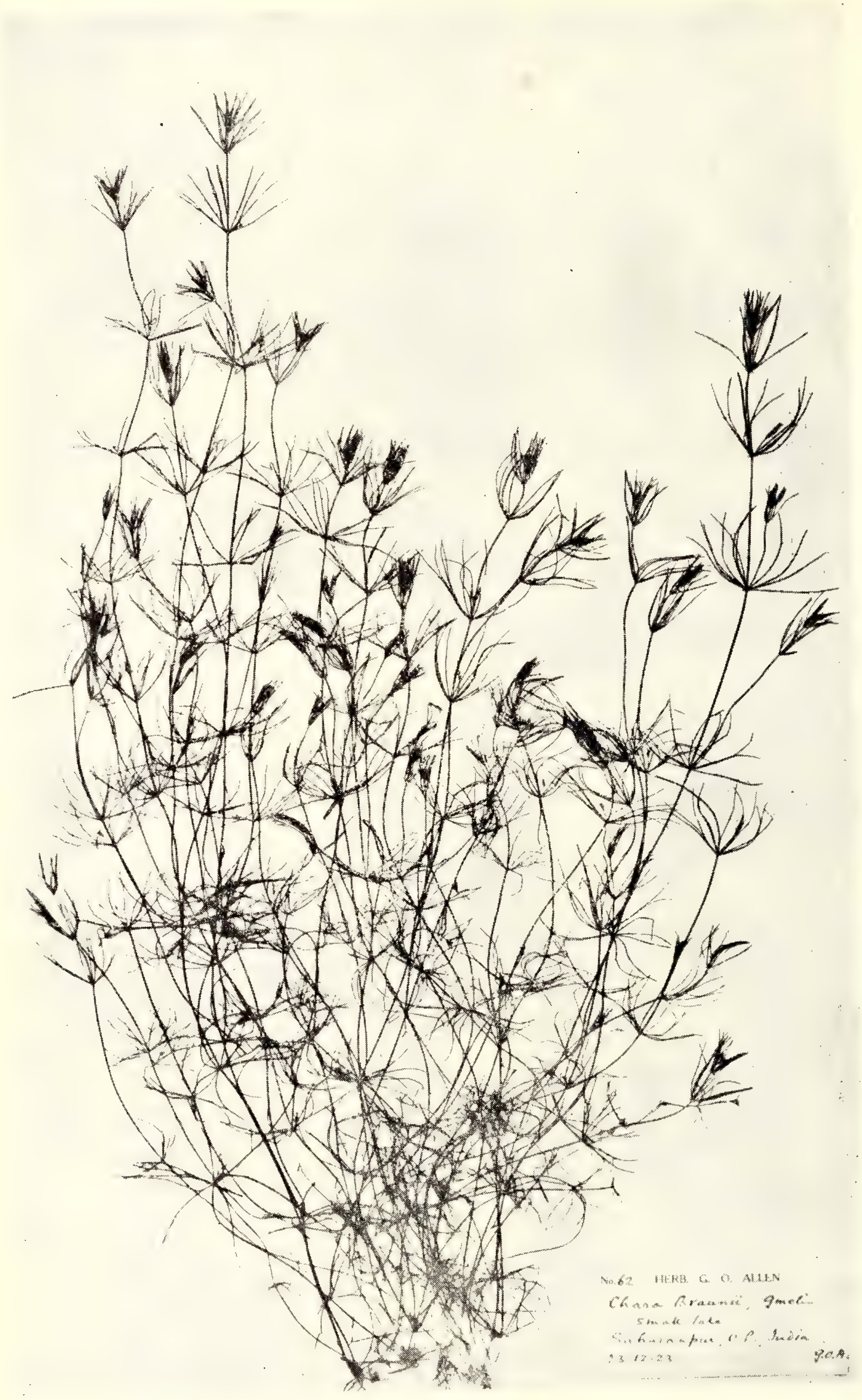


Nitella mirabilis Nordstedt.

Specimens collected in shallow ponds at Saharanpur, U. P.

(Rather less than half natural size.)

CHAROPHYTES FROM GONDA DISTRICT, U. P.


No. 62 HERB. G. O. ALLEN
Chara Braunii, Gmelin
Small lake
Saharanpur, U.P., India
23-12-23
G.O.A.

Chara Braunii Gmel.
(Rather less than half natural size.)

the North of Oudh, the latitude and longitude being about 26 N. and 82 E. respectively. This area lies between the Ghogra river and the outer Himalayas, Nepal forming the Northern boundary. The district is fringed along this latter border with forests but it is of the less picturesque portions that I write. Over 6 per cent.of the whole being under water the district is well suited for the study of aquatic vegetation and from my brief experience a particularly favourable one for Charophytes.

Though strictly outside the scope of my subject, I may be excused if I mention my first experiences. In 1920 I had the good fortune, whilst on leave, to meet Mr. Groves and finding he had been studying Charophytes for a great number of years I suggested that perhaps I might be able to send him some material on my return to India. It was not till I happened to pay a brief visit to Sirinagar a year later about the end of September 1921 that finding these plants numerous in the Dhal Lake I collected a few and despatched them to Mr. Groves on the off chance of their proving of interest to him. In due course I was delighted to find that my first gathering included (in addition to *L. barbatus* and *C. fragilis* specimens both ♂ and ♀ of *N. obtusa* in excellent condition. Prior to this the plant had only been put down with an element of doubt as Asiatic on the strength of a specimen without gametangia of either kind that had been collected in Upper Burma twenty nine years before. My specimens thus definitely settled the species as Asiatic, previous records with the exception of the Burma one having come from Europe only. This early success stimulated me to further efforts on my return to Gonda. During the cold weather of 1921-22 I found several species in this district, my special prize being *N. mirabilis.* This plant had not been recorded from India before : in fact it had only been mentioned in MS. by Dr. Nortsted from a specimen found in China in 1908. It is a most beautiful plant, the remarkable feature being the clusters of long stalked gametangia. My collecting ended with the approach of the hot weather about March and I commenced again towards the end of the rains in September and continued throughout the cold weather of 1922-23 till I left India on leave in March. I found several fresh species that I had not come across the previous year this being partly due to my starting collecting rather earlier. My most important " finds " were *C. wallichii*, *Tolypella prolifera* and *N. batrachosperma*. *C. wallichii* had only been recorded once before namely by Dr. Wallich in 1809 and then only the male plant. I found both sexes and the ♀ has now been described by Mr. Groves in his recent paper. *T. prolifera* had not been recorded from India before, the only other Asiatic record being from China.

The delicate little *N. batrachosperma* had also not been recorded from India before.

The full list of species that I found in Gonda is as follows : *N. mirabilis, N. acuminata, N. mucronata, N. batrachosperma, N. hyalina, T. prolifera, L. barbatus, C. wallichii, C. corallina, C. braunii, C. gymnopitys, C. hydropitys, C. contraria, C. fragilis, C. brachypus,* and *C. zeylanica.*

I have included *C. gymnopitys* though it cannot be said with certainty whether it was this species or *C. flaccida* owing to the specimens that I gathered having no ripe fruit on them. Under *C. flaccida* there is a passage in the Notes on Indian Charophyta as follows " The golden brown ripe oospores afford the only character that I know of to distinguish this from the next species and in many specimens which have passed through our hands the fruit was immature." The " next species " referred to is *C. gymnopitys* in which the ripe oospores are black. My impression is that my specimens were more probably *C. gymnopitys.*

That I should have been able to add a few new records for India and gather sixteen species in so short a time in Gonda goes to show what a little explored field there is here calling for study. The main structures can be readily made out under a low power and there is also plenty of field work to be done as many points about these plants can only be satisfactorily settled by a study of them on the spot.

My collecting was nearly all done in flooded rice fields and a shallow *jhil* (a depression below an old river bank) within a mile of my bungalow with occasional visits to the river Tehri which winds about not far away. This fascinating stream takes its rise in the neighbouring district of Bahraich and is fed by the waters of the great Baghel Tal at Pyagpur. It flows deep and sluggish in a well defined narrow bed fringed by swampy ground and has numerous more or less stagnant backwaters that are utilised as rice fields in the rainy season. It was these swamps and offshoots that I found so rich in Charophytes. The moist area of the district also contains numerous horse shoe shaped *jhils* that mark the old beds of meandering streams but I did not find any opportunity to search them : in fact I found my available time fully occupied by frequent visits to two or three spots near at hand. And there was nearly always something fresh to note : for one peculiar feature that I noticed was the rapid way the different species succeeded one another. One or two continued throughout the cold weather but several disappeared after a short time although flourishing freely for a while. These rapid changes may perhaps be attributed to differences in temperature (for the cold weather sometimes sets in quite suddenly) or to some of the earlier localities getting dried up. The only species I found in the cold weather of 1921-22 that I failed to find the following cold season was. *C. Braunii* but Charophytes are often very capricious in their appearance. Very roughly the periods during which I found the different species to last are as follows :—

(The numbers prefixed are taken from the key to the species in " Notes on Indian Charophyta " by Mr. Groves.)

Stagnant water is the natural habitat for Charophytes. I think the only species I found growing in water that had an appreciable current was *C. wallichii* a powerfully built plant. One or two species seemed to be confined to particular spots. For instance *T. prolifera,* I only came across in a shallow pool near the *jhil* and it was in evidence for a very short time. *N. mirabilis* too, I found growing in abundance only at the shallow end of this *jhil. N. hyalina* was the most widespread of all any shallow water appearing to suit it. *C. hydropitys* and *C. gymnopitys* both of small stature seemed particularly partial to cut rice fields where they might be found in water about a foot deep. As these spots dried up I failed to come across them anywhere else. *C. wallichii* soon disappeared in Gonda as I specially searched for it when I heard it had not been recorded for 113 years I found it however growing in a *jhil* at Lucknow at the beginning of January. *N. batrachosperma* too I only came across at one spot in the *jhil.*

I have included four plates from photographs kindly taken for me at the Forest Research Institute Dehra Dun. They are of dried specimens actually gathered at Saharanpur U. P. but these species are similar to those found at Gonda. Plates illustrating other species are to be found as follows :—

N. mirabilis—Plate 35 in Notes on Indian Charophyta Journ. Linn. Soc. Botany Vol. xlvi. *N. mucronata, N. batrachosperma, N. hyalina* and *T. prolifera* in British Charophyta : *C. Braunii* in " Journal of Botany " for January 1884.

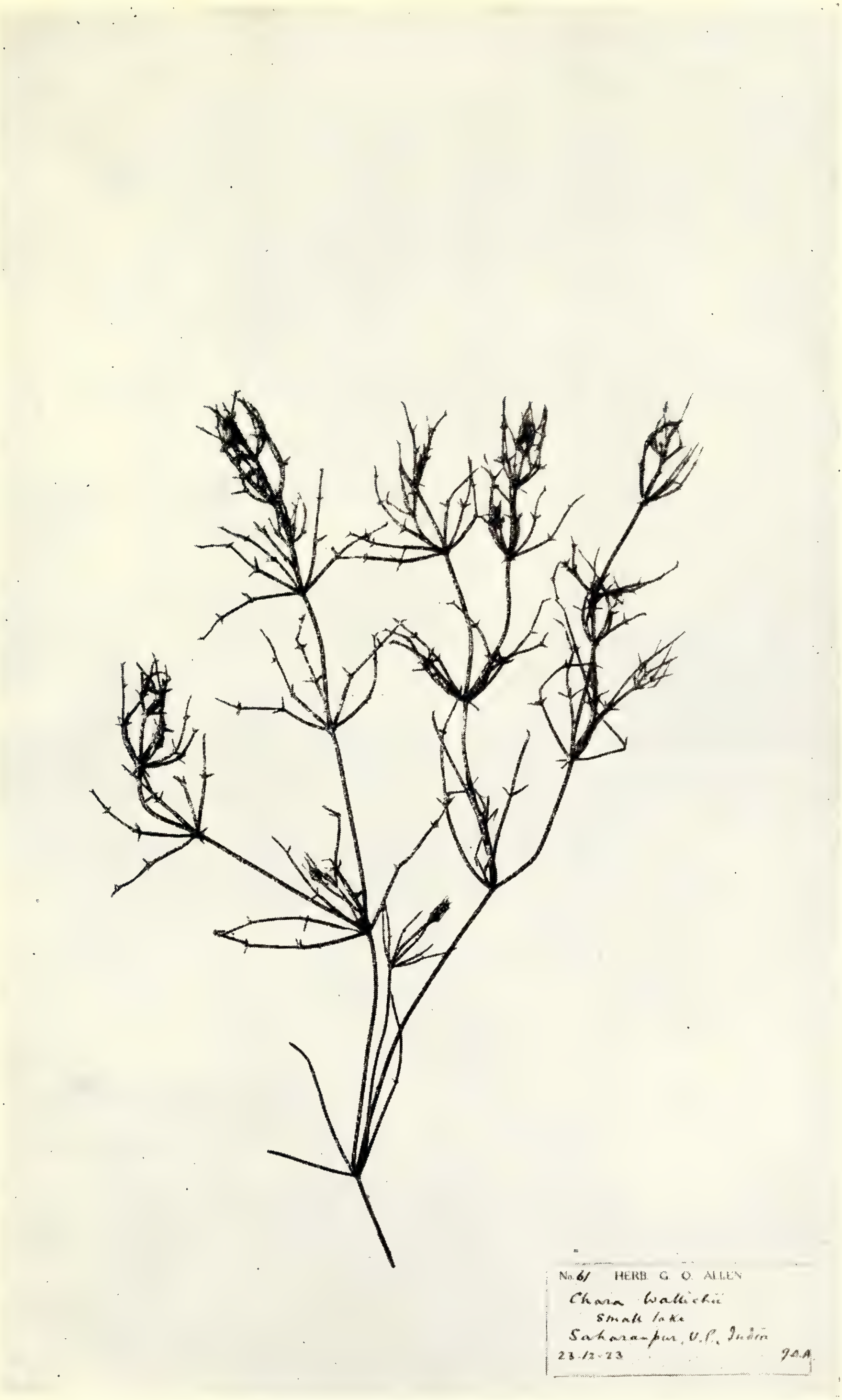
There should be no great difficulty in identifying these Gonda species with the help of the key in the "Notes." I append a few notes that may be of some assistance.

N. acuminata and *N. mirabilis* are the only two *Nitella* with the ultimate rays (dactyls) always one-celled.

N. mucronata has the last cell but one of the dactyl rounded off and the ultimate cell perched on it : a common plant.

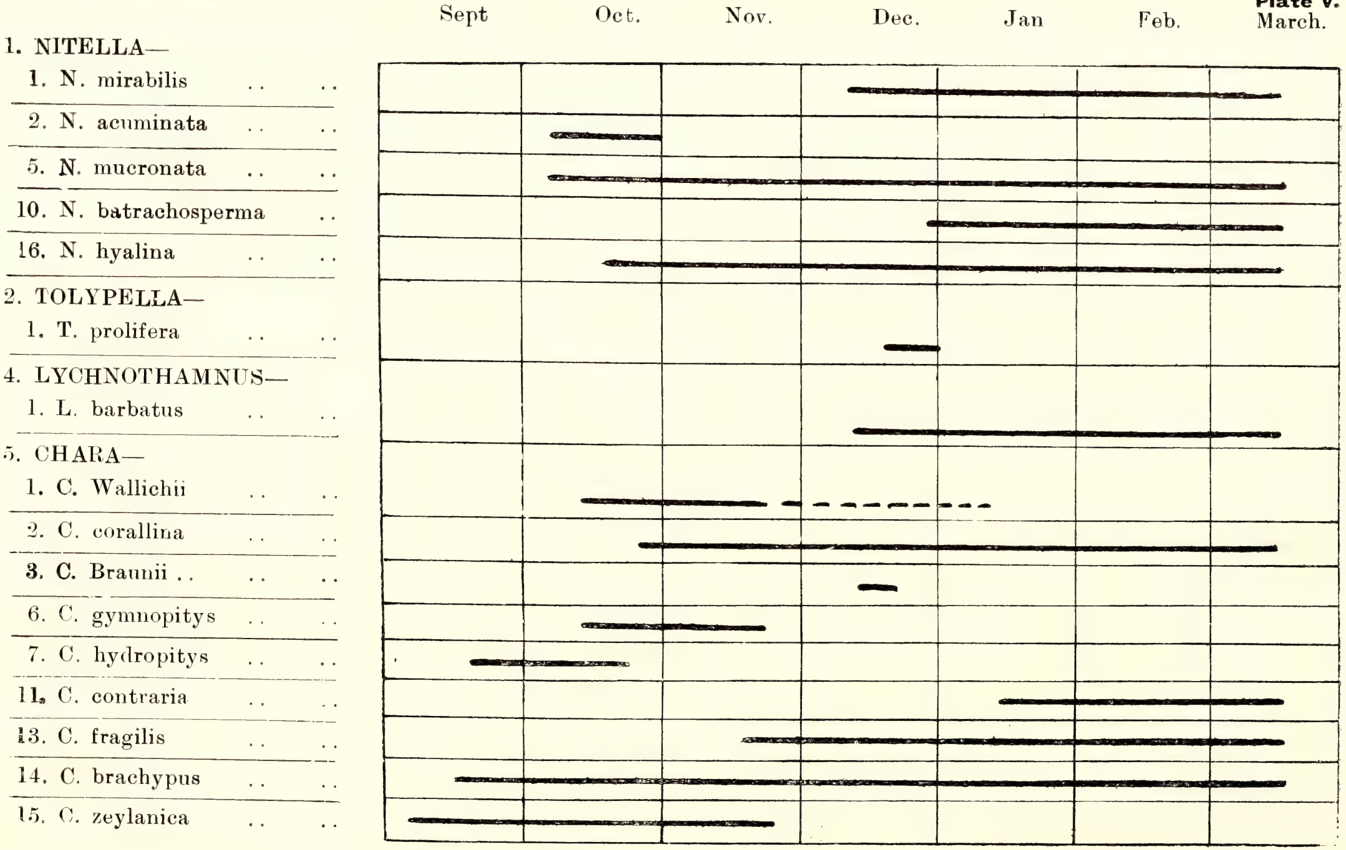
N. batrachosperma is a very delicate little plant growing in small clumps in shallow water in very finely divided mud. Although from its name one would

CHAROPHYTES FROM GONDA DISTRICT, U. P.



No. 61 HERB. G. O. ALLEN
Chara Wallichii
Small lake
Saharanpur, U.P., India
23-12-23 G.O.A.

Chara Wallichii Braun.
(Rather less than half natural size.)


Sept
Oct.
Nov.
Dec.
Jan
Feb.
March.
1. NITELLA—
1. N. mirabilis
2. N. acuminata
5. N. mucronata
10. N. batrachosperma
16. N. hyalina
2. TOLYPELLA—
1. T. prolifera
4. LYCHNOTHAMNUS—
1. L. barbatus
5. CHARA—
1. C. Wallichii
2. C. corallina
3. C. Braunii
6. C. gymnopitys
7. C. hydropitys
11. C. contraria
13. C. fragilis
14. C. brachypus
15. C. zeylanica

expect this plant to be enveloped in mucous I found none at all. *N. hyalina* is easily distinguished by its whorls of different lengths. An abundant plant in the shallower water. Always thickly coated in mucus except quite the oldest parts.

T. prolifera with its long sterile branchlets bears little resemblance to any of the other genera.

L. barbatus is appropriately named as the long stipulodes and bracts give it a bearded appearance. Though it is not very easy to make out the gametangia at first through the mass of bracts the one oogonium between two antheridia distinguishes it from all other Indian Charophytes. *C. Wallichii*, *C. corallina* and *C. Braunii* are alike in being entirely ecorticate and they are all large plants. The first is diœcious while the other two are monœcious. *C. Braunii* is readily distinguishable from *C. corallina* by the reproductive organs being produced only at the nodes of the branchlets whereas in the latter they are produced at the base of the whorl as well. C. *corallina* is a very brittle plant.

C. hydropitys and *C. gymnopitys* are both much smaller plants than the last three. The former has the lowest branchlet segment ecorticate, the rest of the branchlet being corticate. This fact will separate it from all others except C. zeylanica which does not resemble it in other respects. *C. gymnopitys* has the branchlets entirely ecorticate. The remaining four all bear a general resemblance and are much larger than the last two but not so stout in build as the ecorticate Charas. *C. contraria* is distinguished from the other three by the rows of stem cortical cells being only double the number of the branchlets (diplostichous) whereas the others all have three to the branchlet (triplostichous).

This plant most nearly resembles *C. vulgaris,* a very common species though I did not happen to find it at Gonda. *C. fragilis* is likely to be confused with *C. brachypus* but the former has the stipulodes small and blunt and almost rudimentary while the spine cells and bract cells are not acute. *C. brachypus* has the stipulodes sharp and well developed and the spines and bract cells acute. Another distinguishing point about *C. brachypus* is the fact that the lowest branchlet segment in addition to being rather short is colourless or nearly so. *C. zeylanica* is readily distinguished from the two foregoing by the lowest branchlet segment being ecorticate. This plant seems to prefer the rainy season as I found it abundant in great masses at the end of the rains but no sign of it later.

In spite of the very great assistance I have derived from " British Charophyta " and much instructive correspondence with Mr. Groves I fear there are likely to be some inaccuracies in the above though I hope but few.

BIRDS NESTING WITH A CAMERA IN INDIA.

Part IV.

THE Dal Lake AND Hokra.

BY

Capt. R. S. P. Bates.

(*Continued from page* 313 *of this volume.*)

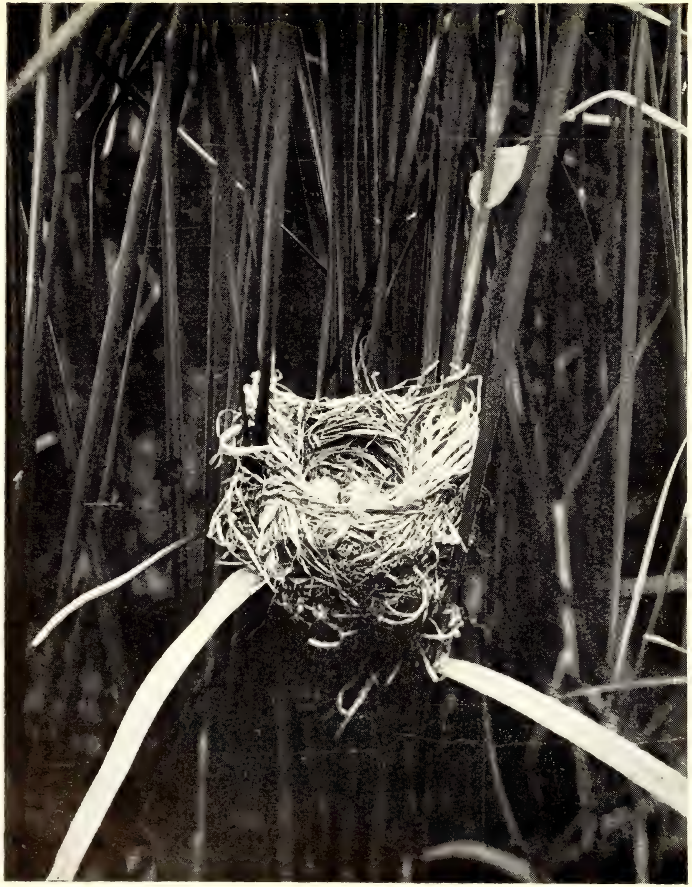
(*With* 6 *plates.*)

Alas! I lack descriptive powers and am by no means of a literary turn of mind. However, as this is primarily an article on birds and their habits, I presume such qualities are not here essential. Even so, it would give me a great deal of satisfaction to be able to describe adequately my thoughts and feelings on the first, no, not only on that first occasion, but whenever I find myself on the clear placid waters of the Dal Lake. Those lotus covered reaches, interspersed with patches of tall and swaying reeds; their background of slender poplars, surrounding the chalet-like cottages; the whole dominated by the towering forest-clad heights culminating in snow-capped Haramouk, fill the heart of the most casual visitor with admiration for their beauty, grandeur and peacefulness. But in me the emotions are additionally intensified by the pulsating life all around one: the strange cat-like mewing of the Pheasant-tailed Jacanas; the chizacking noisy Reed-Warblers, and the plaintive bubbling voice of the Little Grebe from the rushes hard by; the wheeling graceful terns and the slow beat of a Heron's wings, as it majestically sails over the green-carpeted water towards its haven in the giant trees of the Shalimar Bagh. All these combined with that subtle atmosphere of peace and rest, which the Kashmir lakes seem to engender, serve to make one feel at peace with all men, and nature too. Those motionless fishermen, still as statues, standing or kneeling in the prows of their quaint *shikaras* with uplifted trident ready to make a lightening and unerring thrust into the limpid depths at any unsuspecting fish that may venture within their range—what patience they possess; they too add to the calm tranquillity of the whole and seem the very personification of the spirit of Kashmir.

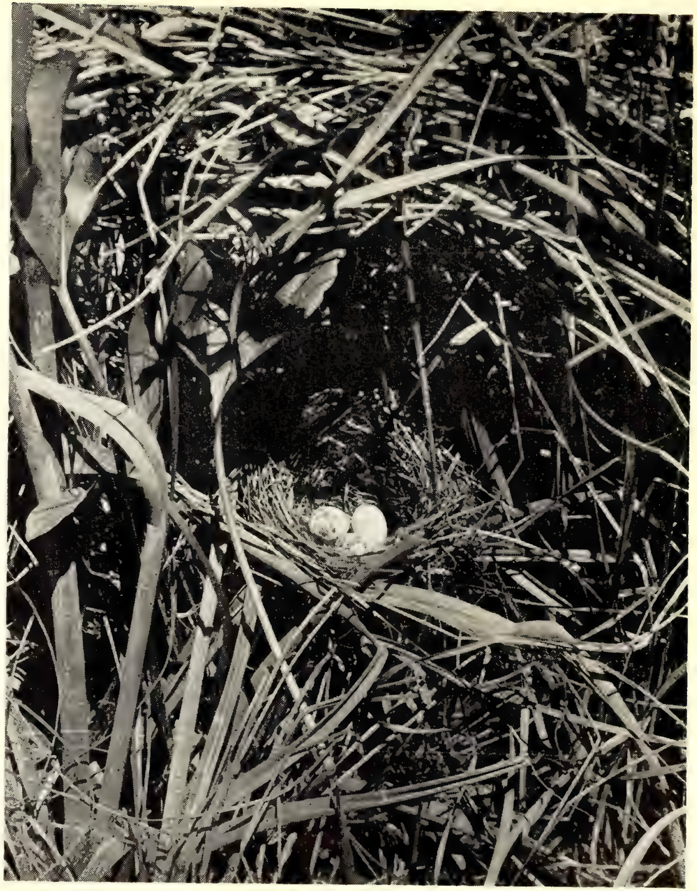
Immediately on passing through the Dal gate certain birds claim one's instant attention. Of these first and foremost comes the beautiful little Central Asian King-fisher (*Alcedo atthis pallasii*), which, practically indentical with that seen more or less sparingly in England, is excessively common throughout the happy valley, and almost before one is through the gate, is certain to be seen sitting on the prow of a house-boat, on a drooping reed, or on a branch of one of the small willows with which the canal banks are lined, every now and then bobbing its head in a most curious manner, as if possessed of terrible indigestion, and no wonder if this really is so, seeing that they insist on swallowing at a gulp fish half as long as themselves.

The Indian Great Reed-Warbler (*Acrocephalus stentoreus brunnescens*) is to be heard rather than seen, as its loud hoarse chattering, proceeding from every reed-bed, is a striking feature of these jhils. The bird itself is rather a retiring creature, though less so than most species of Reed-Warblers, and spends much of its time creeping up and down the rushes in search of insects, occasionally ascending into a tree for the same purpose or to give vent to quite a pleasing little song.

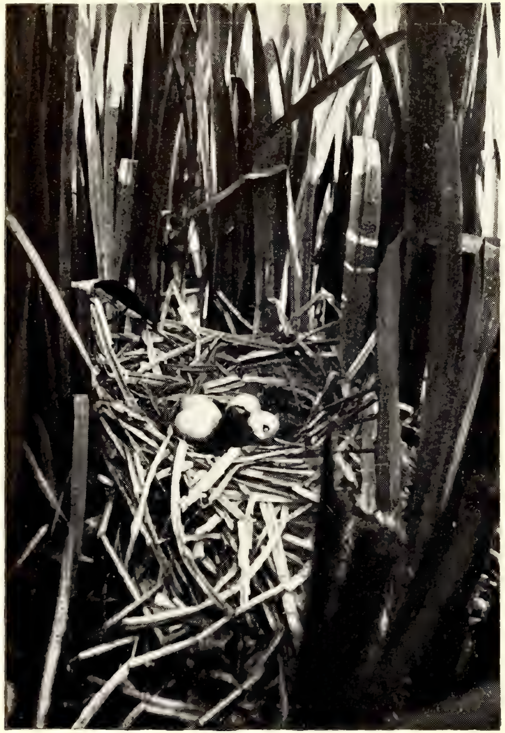
As soon as the reeds have attained to a convenient height, building operations are begun—this is usually about the end of May. The nest, a very deep cup to prevent the eggs being tipped out when the reeds are swaying excessively, is suspended between 3 or 4 reeds about two to four feet above the water. The



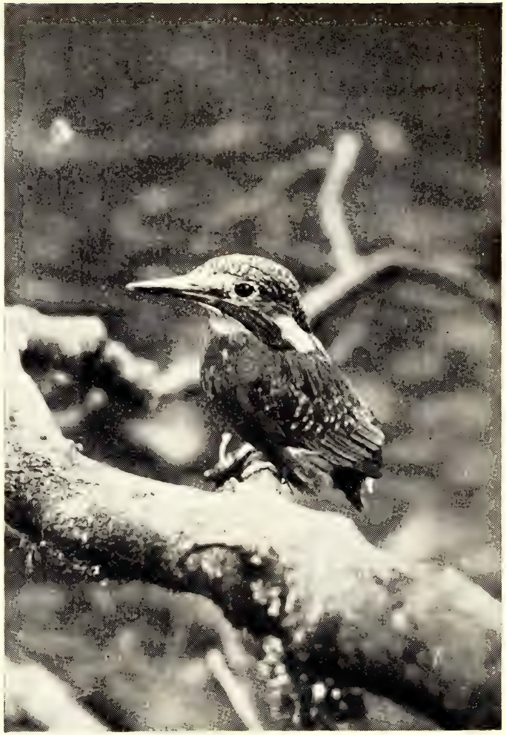
THE INDIAN GREAT REED-WARBLER.
Acrocephalus stentoreus brunnescens.



THE PADDY-FIELD WARBLER.
Acrocephalus agricolus.



THE COMMON COOT.
Fulica atra atra.



THE CENTRAL ASIAN KINGFISHER.
Alcedo atthis pallasii.

THE PHEASANT-TAILED JACANA.
Hydrophasianus chirurgus.

eggs, up to 4 in number, are pale green or grey fairly thickly spotted and blotched with varying shades of grey, red and purple, and are about ·9″ by ·6″ in length and breadth respectively.

I have said above that this bird is rather timid. I have found however that birds of the same species often vary enormously in temperament and this Reed-Warbler is no exception. I was once inspecting the contents of a nest—3 eggs—and actually had my fingers resting on one side of it, when the owner, swearing loudly, pitched on the opposite rim and looked down into its nest as if to see what damage I was doing. Of course, as is generally the case, the reflex was not handy and a perfect opportunity was missed. Usually they are content to creep up unseen and only betray their presence by clamouring loudly a few yards off in the reeds.

The familiar Eastern Swallow too is always to be seen either skimming over the surface of the water or feeding a row of hungry fledglings seated on a horizontal and swaying reed. A Water hen or a Dabchick will probably swim out from the cover, and then, seemingly surprised at its own unwonted boldness, hurriedly sneak back again, bubbling with satisfaction at having been so brave as to show itself to the outside world.

The Little Bittern (*Ixobrychus minutus minutus*) may here often be observed seated on a bent reed or paddling amongst the lotus. Why this bird should prefer to gaze fixedly skywards when apparently fishing for its daily bread is to me a mystery. There he will sit, long neck and dagger-like bill forming a straight line, looking a perfect moonstruck lunatic.

The Central Asian Kingfisher breeds from April to about July in the bank of the canals and rivers and in the sides of the katcha wells, digging a hole from 2 to 4 feet deep with a round chamber at its end, in which it deposits from 5 to 7 glossy white eggs, rounded ovals in shape and about ·8″ in length by ·68″ in breadth. A Kingfisher's nest containing young ones is as unsanitary as a Kashmir village in wet weather, and this, I might explain, is saying a great deal. The passage is floored with a slimy mass of disgorged fish bones, the odour from which is very far from pleasant: yet the youngsters emerge from their dark and odiferous cavern as gorgeously arrayed and apparently as spotlessly clean as their parents.

The Eastern Swallow (*Hirundo rustica gutturalis*) is an early breeder. By half way through June young birds are to be seen everywhere, though still under their parents' care. Their saucer-shaped mud nests, which are softly lined with feathers, are attached to the rafters and beams of the dwelling houses, with the inmates of which they live on the best of terms. The post-office in Srinagar is an excellent example of their partiality for and fearlessness towards human beings, as there they nest in numbers within the rooms crowded with clerks, flitting in and out of the windows close to one's head while one is being attended to. One nest I noticed was within about eighteen inches of a babu's ear and contained young ones, which the parents were feeding every few moments most unconcernedly. On Lake Gagrabal, whose water by the way is most extraordinarily clear, I noticed many Hodgson's Striated Swallows (*Hirundo daurica nepalensis*), *i.e.*, the Red-rumped Swallow of Jerdon. These differ in habits from the Eastern Swallow, in that they build a closed nest with a tubular entrance either in a building or on rocks and cliffs.

The Little Bittern builds from about the end of May a nest of rushes about eight inches to a foot in diameter either on or just above the water. This is anchored amongst the reeds, a few of which are often bent over the nest into a sort of lattice-work roof. The eggs 3 to 5 in number are white rather oval thick shelled and chalky 1·3″ long and 1″ broad.

Having practically come to the end of my leave, and especially wanting photos of a Little Bittern's nest, I decided to spend a morning searching the reed-beds of the Dal Lake. The day very nearly started with tragedy. Water was plentiful that year with the result that the current through the gate was like that of a mill-race. A heavy *dunga*, a country boat, was vainly attempting to force its way through, the crew chanting rythmically as some pushed with long poles and others pulled on the chains on the gate wall. The occupants of a *shikara*, three well-made Kashmiris, also desirous of getting into the lake, were taking advantage of the *dunga* by pulling themselves along its side. We followed suit. The gap between the *dunga* side and the wall was not much more than a yard in breadth. The leading *shikara* was well in this gap when the current caught the *dunga's* prow and swept it across with considerable force, thus pinning the frail boat. Something had to happen and it did very quickly. The *shikara* was crunched up like a piece of match-wood, and its crumpled remains forced under water the crew jumping into the *dunga* in the nick of time, so saving themselves a nasty wetting and possibly worse.

This part of the proceedings was merely highly amusing, as evidenced, by the glee of the crowd that invariably collects on the road over the gate when a boat is going through, even when the water level is normal. We of course enjoyed the play as much as those above, but it was now our own turn to come into the lime light, and our untimely mirth was cut short by the waterlogged remnants of the shikara, which suddenly came up underneath us. My ½-plate camera took a great objection to the awful list of our boat and fell overboard, but as luck would have it I was just in time to grab the strap and pull it inboard before it had had time to get thoroughly wet.

Straight opposite the gate and not 200 yards from it, where the main canal forks, one arm leading direct to that portion of the lake known as the Lokut Dal, the other winding through orchards and vegetable gardens and the picturesque village of Renawari with its massive moghal bridge to the Bod Dal and the Nasim and Shalimar baghs, is a triangular patch of reeds. This I considered too small and too public to yield anything, nevertheless I sent in a man to have a look round having first explained my usual scale of rewards. The promise of a few annas is a great incentive to a Kashmiri. In a few moments he returned with a Moorhen's egg, anxious to know whether this counted, as I had only mentioned large white eggs and small spotted ones. To encourage him I said it did, and duly paid the reward. He was soon back again with a Little Grebe's (*Podiceps ruficollis albipennis*). This time I personally went to investigate, thereby somewhat upsetting the equilibrium of a dear old lady in a passing shikara, as I lowered myself into about 4 feet of water with all my clothes on. The result is shown in the full page illustration.

That meagre patch of reeds yielded no less than the nests of 3 pairs of Little Grebes, 3 of Little Bitterns, 1 of Indian Great Reed-Warblers, as yet empty, and 2 of Moorhens. In a patch on the opposite side of the canal I obtained the photograph of the Reed-Warbler's nest, which is also reproduced here.

Having exhausted the neighbourhood, I was about to move on to the lake itself to look for Pheasant-tailed Jacanas, when another of my minions, whose luck had been out, informed me that he had found a new nest, the reward for which would surely be a large one. What I found was a Reed-Warbler's nest completely filled by, and nearly collapsing under, the weight of two Little Bittern's eggs, which the scoundrel had filched from a nest close by. Curiously enough another man had tried to play practically the same trick on me a couple of weeks previously by putting a Bittern's egg into a crow's nest.

Passing along these canals, which wind for the most part through orchards before finally debouching into the lake, one is likely to notice the following birds in addition to those so far mentioned—the Indian Oriole and Tickell's Ouzel, the Common Indian Bee-Eater, Rufous-backed Shrike, Hodgson's Pied Wagtail, Kashmir Jackdaw, Indian House Crow, Common Pariah Kite, Himalayan Starling, Common Myna, and the Cashmere House Sparrow. In the evenings and early mornings chiefly the European Bee-Eater, a strong and graceful flier, may be seen floating overhead, drawing attention to itself by its pleasant whistling note, and last but not least that graceful poem, the Indian Paradise Flycatcher (*Terpsephone paradisi paradisi*) will be espied flitting amongst the fruit trees like an undulating mass of snow-white cotton-wool. The head and perky crest of the adult male are a beautiful metallic glossed green or rather greenish black, almost the entire remaining plumage is pure white, and the two centre tail-feathers are prolonged into slender appendages some 12 to 14 inches long. At rest, these hang down in a graceful curve : In flight, they wave behind, making the bird appear to ripple through the air.

Before attaining to this amazing perfection, the bird undergoes many changes. On leaving the nest one might quite well take it for a bulbul of some sort, as I for one did, when I first made its acquaintance in Rajputana soon after my arrival in India, even though armed with that admirable little book for beginners, Douglas Dewar's "Bird Calendar for Northern India." At this stage the plumage with the exception of the head and crest, which are glossy black from the outset, is largely chestnut, and the centre tail feathers are not elongated. The female never doffs this garb, and the male not until his second autumn moult, and it is not until he is some four years old that his metamorphosis is complete.

The nest of the Paradise Flycatcher is nearly as beautiful as the bird, being a neatly woven fairly thin-walled cup of grass plastered with cobwebs and lichen and lined with hairs. It is placed either in a slender fork or on top of a more or less horizontal branch, usually no great height up and more often than not in a fruit tree. The eggs up to 4 in number are a beautiful pink, sometimes quite salmon, spotted and speckled with red, rather resembling those of our common Swallow.

All the above-mentioned with the exception perhaps of the European Bee-Eaters will be found breeding about the end of May. The Indian Orioles will be building their basket-like nests in the fruit trees or chenars or even the willows lining the canal banks. The nest is a most interesting structure, and is built as follows. A strip of fresh bark is wound round one limb of a forked branch and carried thence to the other limb. A rough equilateral triangle with about a six inch side is thus formed. Other strips are then wound on until a cradle is obtained and in this the grass nest is woven. The eggs two or three in number are fairly large about 1·1″ by ·8″ rather blunt ovals, and are white with a number of either dark red or black spots distributed over the surface. The Oriole, although its nest is generally in a well protected situation, or even in an inaccessible one—I have spotted nests in the topmost and slenderest branches of giant chenar trees—is a very light sitter ; such a light sitter indeed that one will hardly ever be permitted a glimpse of her at home. The Orioles too possess some fine liquid notes, which one cannot fail to remark. A description of the bird is unnecessary, the only other bird, which at all resembles it, and one which I have seen pretty frequently in Srinagar itself, being the Black and Yellow Grosbeak (*Perrisospiza icteroides icteroides*), which of course is a finch, black-headed and much smaller.

The Rufous-backed Shrike (*Lanius schach erythronotus*) literally forces itself on one's attention from the moment the happy valley is entered. Every few yards a nest will be noticed built against the trunk of one of the poplars, which so closely line the main-road, and usually about 10 or 12 feet up amongst the cluster of fine twigs and smaller branches which commence about that height from the ground. How many hundreds of these nests, old and new, there must be between Baramullah and Srinagar it is impossible to say. Some day perhaps an enthusiast who is really hard up for a job, will count them and publish the result of his census in the Strand Magazine or the Daily Mail, in the space usually reserved for telling us the height of a pyramid built of the Maconachie rations consumed by the British Army during the war and other such world-shaking information. At any rate the Rufous-backed Shrike may be put down as one of the commonest birds of the valley, and besides frequenting these poplars is to be found in every orchard and garden and round every village. It is a veritable bird of prey, although its victims are nothing more formidable than grasshoppers and beetles, and occasionally, I believe, though I have never witnessed it myself, a young bird. They are certainly very fierce, and up to mobbing birds much bigger than they themselves. They perch a few feet from the ground in a tree or bush and sail down at an angle on to their prey. The extent of their breeding season is considerable and commences about the beginning of May. The nest is rather bulky and often loosely constructed, containing a considerable amount of rubbish such as dirty rags, bits of paper, leaves, etc. The eggs 3, 4 or 5 are somewhat larger than one would expect measuring about ·9″ by ·7″, and are rather pretty, being greenish white with fairly large spots and sometimes blotches of different shades of red and brown.

The Common Indian Bee-Eater (*Merops orientalis orientalis*) is very common throughout the length and breadth of India, and must be familiar to any one long before they reach Kashmir, as one cannot help seeing hundreds during any railway journey sitting on the telegraph wires quite unperturbed by the passage of the train. The side of any bank, ditch or sandy mound affords a position for the entrance to the narrow tunnel which the birds dig for their home. This is sometimes as much as five feet long and terminates in a rounded chamber in which the 5 white eggs are deposited. These measure about ·8″ by ·7″.

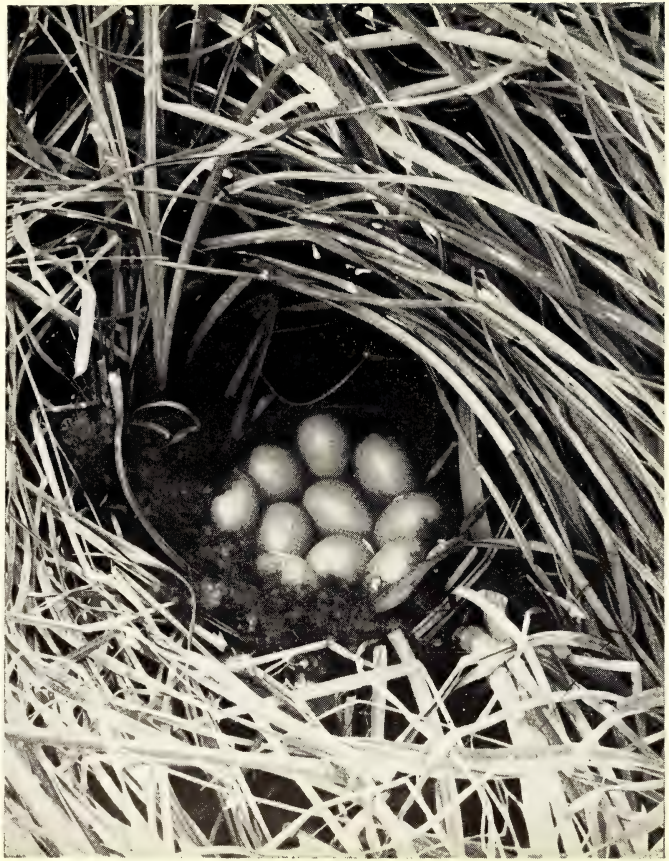
Hodgson's Pied Wagtail (*Motacilla alba hodgsoni*) is quite a confiding bird and often utilizes the roofs of the house-boats, or the inside of a rolled-up ' chick ' for its nesting site. On one occasion I picked up my boat at Baramullah, and was joined, as we left, by a pair of these wagtails, which at once commenced building inside a chick intended for the verandah. As the boat was on the move they occasionally got left quite a distance behind, as they had perforce to visit the river banks to collect material. At Bandipur they left me, as I am sorry to say the boatman, against orders of course, let down the chick and destroyed the nest, which was already of quite decent proportions.

From the beginning of May they breed freely wherever found, other and more usual situations being in cavities in the river and canal banks, under stones and in the masonry of bridges, or in the roots of bushes close to the water's edge, etc., and by half way through the month I have found many nests containing young ones. The latest date on which I have found a nest with eggs (near Pahlgam in the Liddar Valley) was July 8th and these, 5 in number, were quite fresh.

The Indian Hoopoes (*Upupa epops orientalis*) are early breeders in Kashmir, and by the beginning of June have practically finished operations for the year. Holes at the bases of the walls of the dwelling houses are their favourite abodes, though hollows in trees are also patronised. Like the Kingfishers too by no manner of means can they be congratulated on their sanitation.

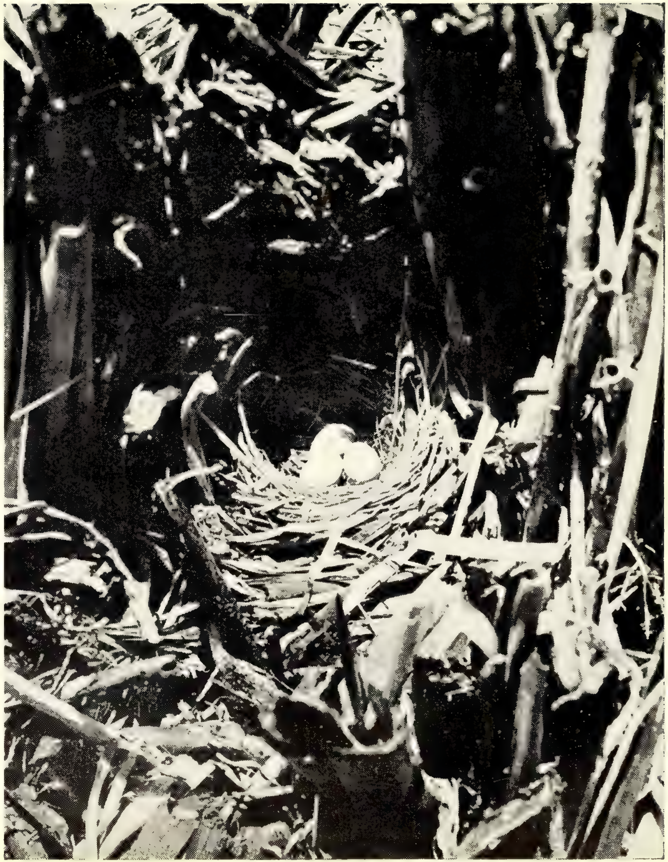
Tickell's Ouzel (*Planesticus unicolor*) is a common bird in the gardens of Srinagar and round about the villages. The nests are like those of the Blackbird at home, and built in a fork of a bush or tree at anything from 6 feet or so upwards. They are not conspicuous birds but have a very pretty song and occupy the same position in Kashmir as the Blackbird does at home. Their eggs too are like those of the Blackbird resembling them very closely indeed though the markings are perhaps redder, and they are to be obtained from about the end or possibly half way through May.

The Kashmir Jackdaw (*Corvus monedula soemmeringii*) is another very common bird in the Happy Valley and very much outnumbers the Indian House Crow. Every Chenar of decent proportions holds its quota, as the many holes in these magnificent trees afford the most excellent sites for the nests of this species, one tree often containing many pairs. The Jackdaws are also well



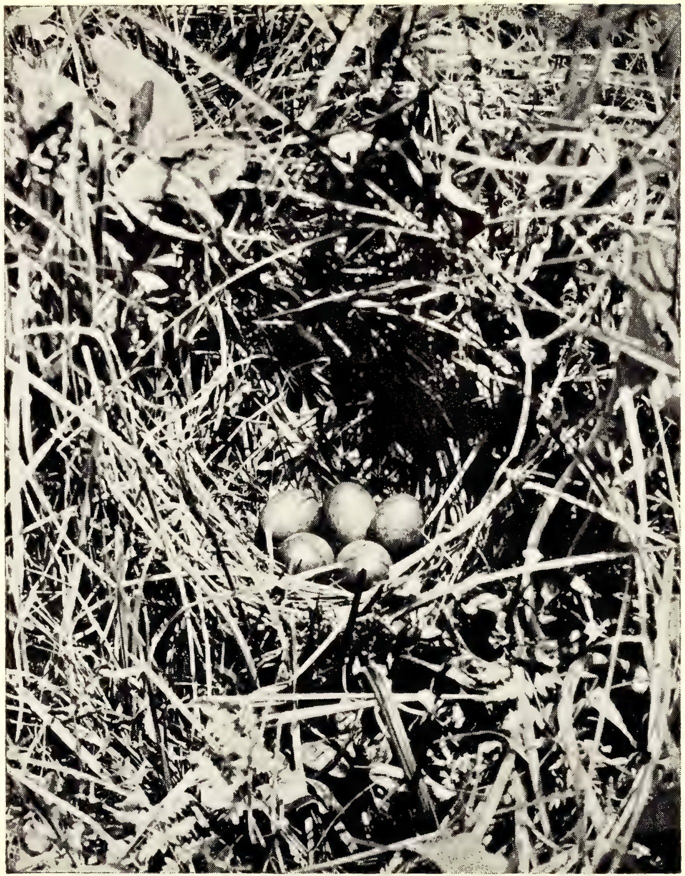
THE WHITE-EYED POCHARD.

Nycroca rufa rufa.

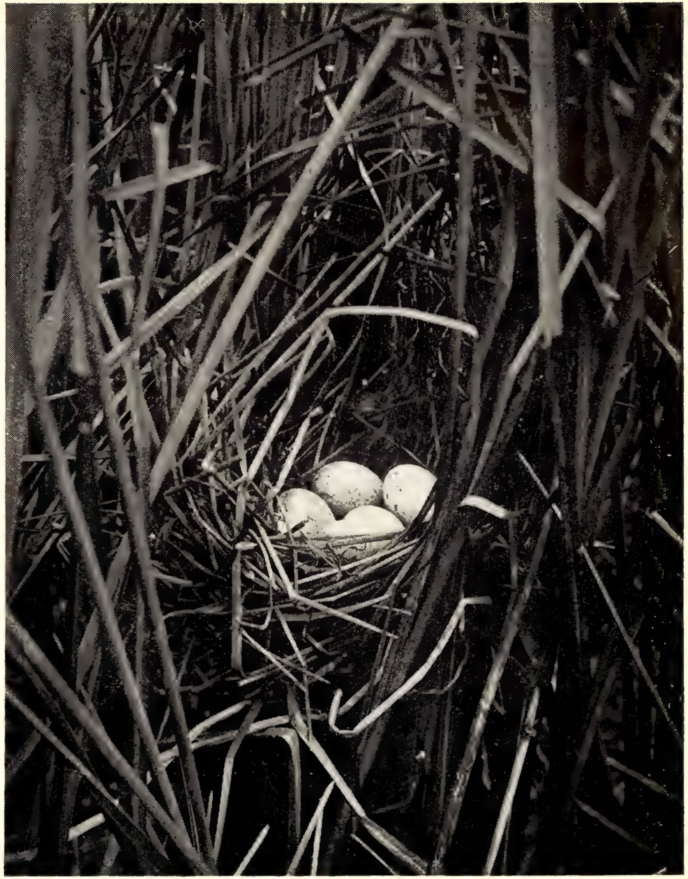


HODGSON'S YELLOW-HEADED WAGTAIL.

Motacilla citreola citreoloides.



THE EASTERN BAILLON'S CRAKE.
Porzana pusilla pusilla.



THE NORTHERN RUDDY CRAKE.
Amaurornis fuscus bakeri.

ahead of the House Crows in domestic duties and have young out by the end of May, when the latter are but just commencing to build.

In Srinagar a favourite situation for the nests of the Crows is upon the wooden stanchions holding up the projecting upper stories and balconies of the houses overhanging the river. Midway through May I noticed a good many nests being built on the low trees of the small island one passes immediately on entering the Bod Dal, but at the beginning of June they appeared to have got no further on, and I conclude that their eggs must be taken by the natives.

The Common Pariah Kite of Kashmir, besides being considerably larger than his plain's brother, has very much more pronounced whitish patches on the underside of the wing. Their large untidy stick nests may be noticed high up in the chenars round about the villages and by May those eggs which are still to be found are almost certain to be well incubated. These kites are arrant baby-snatchers, and the shouts of the Kashmiri womenfolk are continually to be heard during the hours of daylight, as they attempt to keep them off their chickens and ducklings, often unsuccessfully I fear.

On emerging from the canal into the Bod Dal, one passes through floating gardens and large patches of green and swaying reeds until confronted by a small island bearing an enormous half dead chenar, in the upper branches of which is generally a Kite's nest. In May the lotus has hardly made its appearance except in the shallower reaches, and as one slides peacefully past the isle a wide stretch of deep blue water suddenly meets the eye, over which may be seen a few Whiskered Terns (*Chlidonias leucopareia indica*) gracefully dipping to the water, while uttering their harsh and rasping call. An occasional Night Heron (*Nycticorax nycticorax nycticorax*) perched on a bent reed or an awkward Little Bittern may be remarked close to the reed-beds one has just passed through, and an Eastern Marsh Harrier (*Circus spilonotus*) will probably be descried gliding over the tops of the reeds, every now and then descending into them after its prey. But the strangest bird and the one that will arrest the attention immediately is the Pheasant-tailed Jaçana (*Hydrophasianus chirurgus*). The weird cat-like cries of these peculiar birds alone cannot fail to strike one, but the more one discovers about them the more one's wonder grows. Surely they were once common or garden chickens, which in some remote age forgot themselves and took to the water, thereby perhaps giving rise to the term water-fowl as opposed to the fowls of the air, and the barn-door fowl. Who knows ! The male in breeding plumage with his long black tail-feathers certainly resembles a quaintly coloured cockrel, an unhappily coloured cockrel, the mixture and arrangement of its black white and yellow plumage being decidedly trying in my opinion.

Many of these birds may be seen, most of them fairly close to the shore or reed patches, but some in the very centre of the lake, apparently walking on the surface of the water. In reality these last are on the weeds which are now just reaching the surface, and the ease with which they progress without sinking is due to the exceptionally long toes with which they are provided, the centre toe of a Pheasant-tailed Jaçana being as much as three inches in length and the hind toe, the greater part of which is claw, two. The nest of this bird is a mere pad of weeds or rushes varying considerably in scantiness, as evidenced by the photograph reproduced here, in which I failed to discover any materials at all. This nest was on a thick layer of soggy weed, so the owner probably thought and rightly so that materials were unnecessary. A more usual situation is out amongst the lotus leaves, but on this occasion, a backward year, the lotus had hardly made its appearance when I left Kashmir half way through June. The photo was actually taken on June 7th. The eggs are as strange as the bird, being flat topped and tappered to a pretty sharp point at the small end. In colour they vary considerably and I have seen green eggs, clay coloured eggs and bronze eggs, and one clutch I took looked just as if they had been painted with gold size and absolutely sparkled. I am afraid I ravished this, the only nest I found that day, as I had discovered that they knock the much vaunted

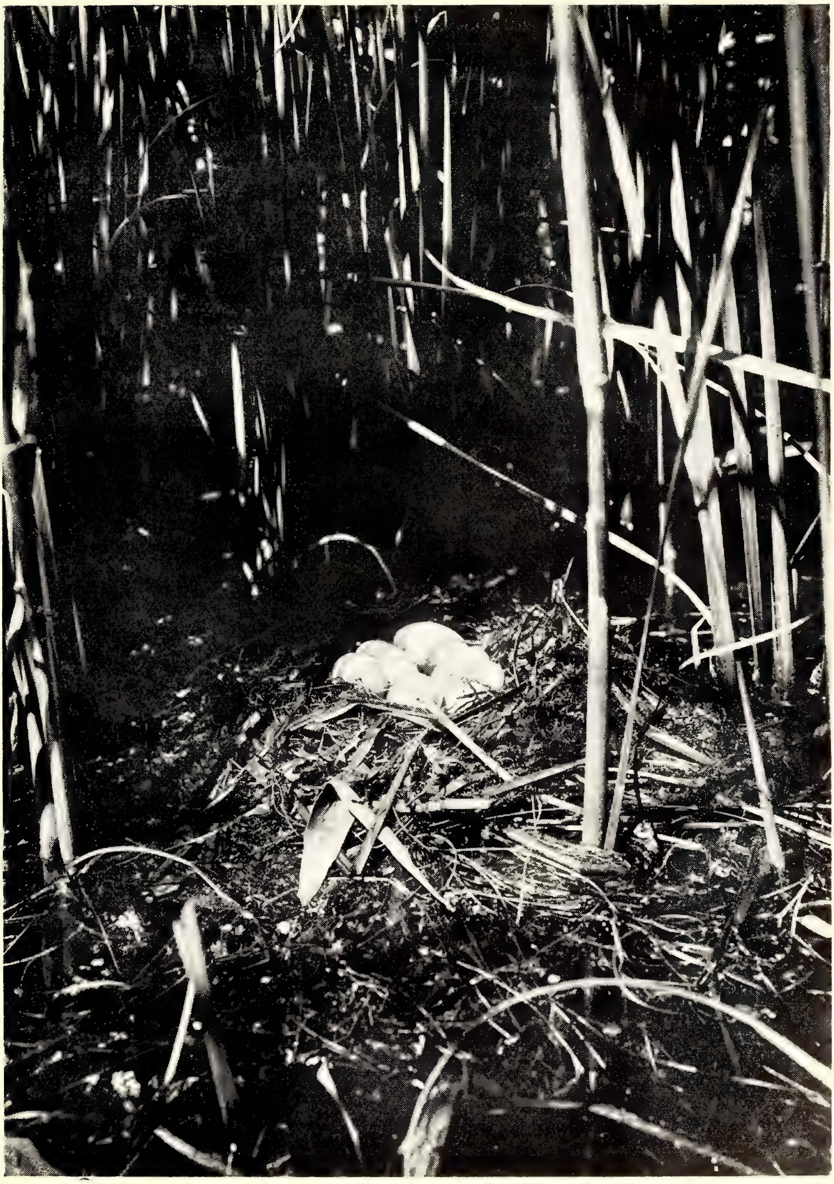
Plover's egg into fiddlesticks. The white is beautifully clear and the yolk literally melts in the mouth like butter. In fact I can thoroughly recommend them to the epicure. They are quite a respectable mouthful too, measuring about 1·5″ by 1·1″.

While crossing the lake to where I found this Pheasant-tailed Jaçana's nest, which by the way was not far distant from the entrance of the canal to the Shalimar Bagh, I was very much surprised to come upon an Indian Little Grebe finishing off a nest in the very centre of the lake, literally miles from the shore or any of the reed beds and absolutely unconcealed in any way, a most strange situation for so shy a bird, though last year on the Ulsoor Tank in the middle of Bangalore I noticed two nests in the open water only a few yards from the bank, alongside which runs a busy thoroughfare. I suppose the lake must have been fairly shallow at this point as the weeds were just appearing on the surface over a considerable area, and it was in this patch that the nest was being built.

The Indian Whiskered Terns (*Chlidonias leucopareia indica*), which make their nests, untidy pads of weeds and rushes, in colonies on the surface of all the jhils of the valley, have a very hard time of it in the Dal Lake I am afraid, and few, if any, can ever succeed in raising a family. I particularly wanted a photograph, but the nearest I came to finding a nest with the requisite number of eggs in it, was seeing a fisherman collect literally every single egg he could from the colony I was heading for, and make off before I could get close enough to tell him what I thought of his ancestors, himself and all his offspring. One solitary egg was all he had left behind him, and there must have been at least twenty nests. I must admit that these eggs too are undoubtedly good eating, and I have on occasions abetted these egg thieves by buying their ill-gotton spoils from them.

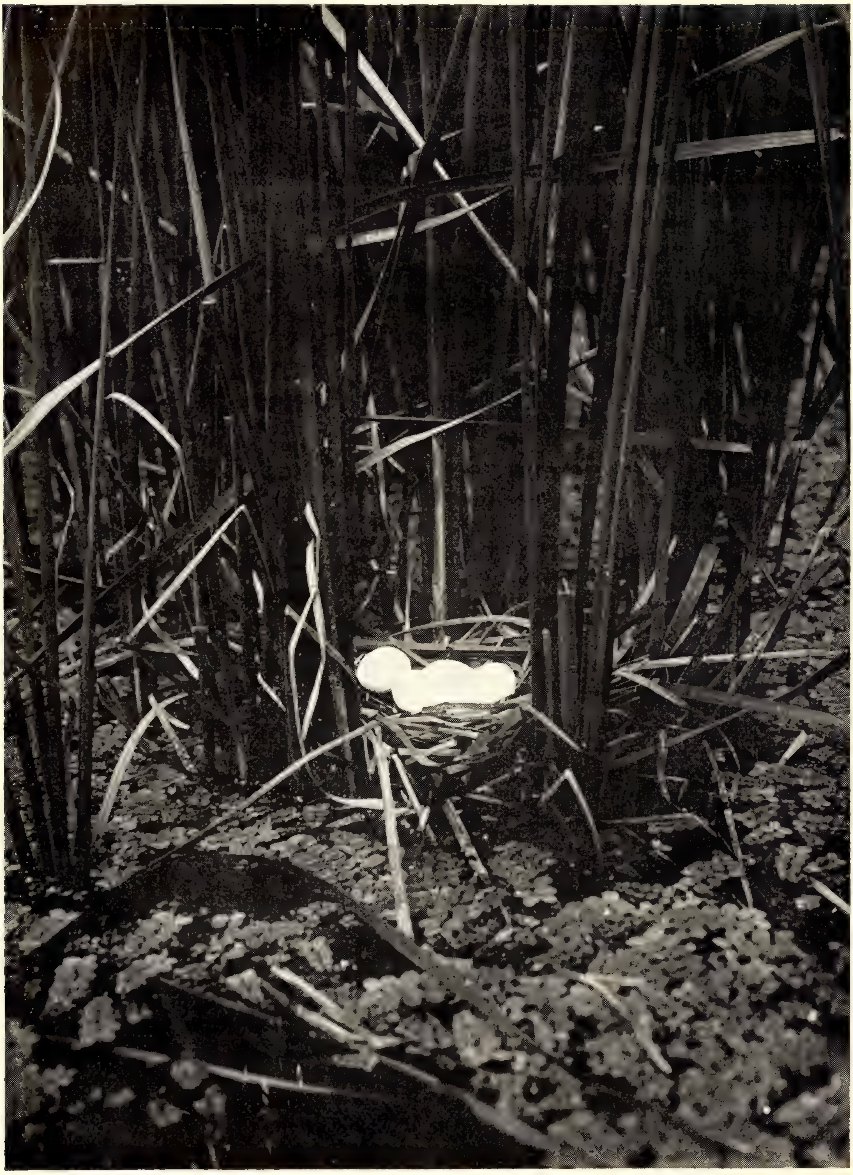
A common bird about the main portions of the lake is Hodgson's Yellow-headed Wagtail (*Motacilla citreola citreoloides*) though I have not actually found their nests in the Dal, but both this bird and the Paddy-Field Warbler (*Acrocephalus agricolus*), which one may also come across in certain parts of the lake, breed very freely on Hokra and other jhils of a similar type, and in consequence I will describe what I found on a couple of visits to that jhil on June 18th and 21st, 1921, in company with Captain Livesey, who kindly obtained a permit for me along with his own.

I appear to have forgotten all about the spry little Kashmir Grey Tit (*Parus major kashmiriensis*), a bird rather resembling the Great Tit of the British Isles, both in appearance and habits. I was struck by the numbers of this species exploring the leafy pall of the magnificent chenars in the Nasim Bagh. On the 19th May I took one of their nests in a hole in the bank of a canal leading into the Anchar Lake. I was looking for Kingfisher's nests and seeing a likely looking excavation gently pushed a stick down it. I was startled by a violent hiss, which was repeated every time the stick was moved. I thought it must be emitted by a snake, so out of mere curiosity set to work to open up the place, digging downwards from a point which I judged to be directly over the end of the hole. When I got into it, I was more than surprised to see a very angry looking Grey Tit, with large lumps of fallen earth almost burying it, sitting tightly on a large pad of wool which completely filled the floor of the chamber I had laid bare. The defensive attitude of these birds on the nest is somewhat strange. The tail is spread wide into a sort of fan and the head sunk into the soft wad of the nest so that the bill is almost invisible and a pair of very beady black eyes just peep over the rim. The bravery of this particular little heroine was such that she actually allowed me to remove the debris from the nest and her back, only hissing loudly when my fingers came close to her head. She allowed me to fix up the camera with its staring lens but a couple of feet or so from her, and would, I am sure, have let me get all the photos I wanted, had not



THE INDIAN LITTLE GREBE.

Podiceps ruficollis albipennis.



THE LITTLE BITTERN.

Ixobrychus minutus minutus.

a sudden gust of wind blown the focussing cloth right off the camera on to her long-suffering head. This proved too much for her nerves and she fluttered out of the hole disclosing seven red-spotted egg, which, on immersion in the canal, proved to be quite fresh.

Hokra Jhil is within a few hundred yards of the main Baramullah-Srinagar road opposite Shaltin, but one would certainly never suspect its presence, even if told where it lay, as a low bund lies between, and it is surrounded by ricefields and nearer at hand by a considerable strip of low lying more or less wet spongy ground, covered with soft grass of varying length interspersed with a few scraggy little bushes, mere prickly stalks a few inches to a few feet in height. It is on this wet ground that from about the commencement of June, Hodgson's Yellow-headed Wagtails may be found breeding in their hundreds. The nest is rarely if ever on really dry ground and its base in fact is often wet. It is generally a well built cup of grass placed in the centre of a tuft or at the foot of a bush or even in soft grass of a length barely sufficient to hide the nest and may contain from 3 to 5 eggs. These vary very considerably but all are of a most decidedly greenish tinge, mottled or streaked with greyish or reddish brown, many of them rather resembling those of the Grey Wagtail (*Motacilla cinerea melanope*), than which however they are slightly bigger and more oval in shape. On June 21st I found one nest containing a pair of well-developed young ones, but all the other nests, and we hit upon a good many, still held eggs, a number not even their full quota. A very noticeable feature about the nesting females of this species was the considerable variation of the brightness of their colouration, many of them evidently breeding while still in different stages of immature plumage. The nest illustrated here was in a patch of reeds, which had been cut down to their roots. The ground was so waterlogged that the base of the nest was soaking wet and even the lining quite damp. It was dangerous stuff to walk on and swayed perilously, evidently being but a layer of tangled roots floating over deep water.

In places the soft grass attains a length of three or even four or more feet, and in this and in the slender reeds, which in places grow amongst it, the Paddy-field Warblers conceal their nests. These are neat little cups of grass and moss suspended in exactly the same manner as those of the Indian Great Reed-Warbler and are generally very well hidden, as the tangle of soft grass, in which they are usually placed pretty low down, affords complete concealment from view. They are not really shy and by patiently watching them from a short distance away, one should be able to mark down the position of a nest to within a few feet, after which a thorough search will do the rest. The eggs of this little warbler are by no means unlike those of the Indian Great Reed-Warbler, but are smaller, generally more elongate, and less thickly marked.

On June 18th we were only able to find a couple of nests both of which were still being built, but on the 21st we found another containing 3 eggs, the photograph of which is reproduced here. The Paddy-field Warbler is very much smaller and also quieter than its strident voiced cousin ; the tail is more graduated and the throat of a deeper rufous tinge.

The Indian Great Reed-Warblers were of course breeding as profusely here as elsewhere in the valley, and their harsh grating voices were to be heard emanating from all the coarser reed patches, and other nesting birds, which I have already mentioned as inhabiting the Dal, were Moorhens, Little Grebes, Little Bitterns, Pheasant-tailed Jaçanas and Whiskered Terns. Coots also were common. The Coot's nest in the illustration was not actually taken at Hokra, but I include it here as it is interesting on account of the young one, which appeared to me to be in quite a fit state to take to the water. In fact, after procuring the photograph, I put it into that element and it swam off quite strongly into the reeds, where it probably joined its brothers and sisters already in hiding. These youngsters are as a rule capable of swimming practically from the moment they are hatched, and at the approach of danger immediately leave the nest and hide in the surrounding cover. Why this one had not done so I cannot imagine. It will be noticed that another is on the point of emerging from the egg. The hard whitish nob on the tip of the upper mandible can be seen quite plainly.

Hokra, being a state "*rukh*" and so undisturbed by the spring influx of tourists, is a sanctuary where the shyer and more seclusion-loving waterfowl betake themselves, or rather remain, after the spring migration has taken place, and White-eyed Pochard (*Nyroca rufa rufa*) and Mallard (*Anas platyrhyncha platyrhyncha*) breed in considerable numbers. I also remember seeing many Teal and a few Widgeon (*Mareca penelope*).

A White-eyed Pochards' nest containing ten eggs, fairly well advanced in incubation, and surrounded by a goodly quantity of down, was discovered in the centre of a very tangled mass of reeds. The eggs were a very pale *cafe-au-lait* and had a decidedly satiny surface,so, nestling amongst their dark-hued padding, they made a most pleasing picture.

Quite close in a most awkward spot to reach, owing to the amount of water and thickness of the reeds, was a Mallard's nest. This contained a large number of ducklings when first discovered, but all but two of them and one which still had a considerable portion of the shell attached to its rear end, escaped into the surrounding reeds while I was struggling to reach the nest. Two chipped eggs also remained. The photo I obtained did not come up to expectations and is not worth reproducing here, that is useless it were intended to show how perfectly the colouration of a duckling can blend with its normal background of reeds, as, though the image is perfectly sharp and the head alone the size of a pea, it is most difficult to pick it out.

One of our chief reasons in obtaining permission to visit Hokra was that we hoped to find the Snipe with eggs, but though we put up a considerable number we were unsuccessful in our search. The Common Fantail Snipe (*Gallinago gallinago gallinago*), and also that fraud, so far as shooting is concerned, the Painted Snipe (*Rostratulla benghalensis benghalensis*) are both to be found breeding around these more sequestered and marshly jhils with their surrounding area of spongy ground, which the Fantails seem especially to seek after in Kashmir, but I think one should look for their nests earlier than towards the end of June, even though they do appear to nest rather later here than is usually the case with this species.

On the 18th before we had progressed a hundred yards round the edge of the jhil, an Eastern Baillon's Crake (*Porzana pusilla pusilla*) was flushed off its nest of five eggs. These tiny little rails are very common in Kashmir, and as they sit very close and often fly straight off the nest, their abodes are not over difficult to find. How these minute birds, the smallest of all our rails, manage to cover their numerous eggs is beyond me. They lay anything from 5 up to 9 and these are decidedly large in proportion to the size of the bird, whose body really cannot be much larger than that of a sparrow. Yet the average egg measures about 1·2″ by ·85″. The nest is composed of a small collection of grass or reeds and is often placed in soft marsh grass, in the grass on the side of a bank, or at the foot of a bush, and resting on more or less solid ground, and possibly more frequently anchored over water amongst reeds, a number of which are bent over the eggs into a canopy. In fact the situations are much the same as those chosen by the Northern *Ruddy* Crake (*Amaurornis fuscus bakeri*) with the exception perhaps of the first named and the fact that whereas the former has a predelection for the vicinity of jhils, the latter appears to shun them.

The latter also breeds commonly in the Valley, and on both occasions eggs were brought to us. One enterprising youth brought the female bird also, which he had managed to catch on the nest, quite how I don't know. She had an egg in the oviduct which could be easily felt and as easily seen, as they too are decidedly large in proportion to the size of the bird. We let her go, but rather than exercise her wings, she dropped straight on to the water and went swimming off up a side ditch, sneaking along its edge and swimming with the same jerky motions as the Moorhen. The Ruddy Crake does not seem to like the large reed-covered jhils, but shows a great preference for the rice-fields and the ditches which supply them. Their nests are to be found on the banks, which divide the fields, in tangled undergrowth in their vicinity and also attached to the rice stalks or reeds, a number of which are bent over the nest to form a partial roof, giving to the nest a most pleasing appearance. June is really a bit too early to expect to find full clutches, as they are rather late breeders, and it was only well on in July, just before I went down from Kashmir, that I found nests with their full compliment of eggs.

(To be continued).

THE IDENTIFICATION OF INDIAN BUTTERFLIES.

By Colonel W. H. Evans, D.S.O., F.Z.S., F.E.S.

(*Continued from page* 351 *of this Volume.*)

Part VII.

(*With one Plate.*)

H. 30. Nacaduba.—The Lineblues. (Plate 27.)

Dark blue with borders linear in ♂ ; above and below brown with a number of parallel whitish lines. ♀ ♀ discally pale blue or white with broad dark borders.

1a (a). Unf no pale basal lines, only a pair end cell and a discal pair in addition to the marginal markings.

1 (2a). Unh prominent round black spot at apex, ♂ upf purple blue with a more or less prominent diffused discal white patch on F. ♀ white. Below white, the 2 submarginal rows of dark linear spots prominent, other markings pale brown and obsolescent.

* *angusta kerriana, Dist.* (32-35). The White Lineblue. Karens—S. Burma.R.

2a (1). Unh no prominent apical black spot. Below brown with white lines discal markings prominent, submarginal not more prominent. ♀ ♀ pale blue or violet.

2b (5). Unf outer discal line does not meet inner submarginal line at v3. Above lines from below not showing through by transparency.

2 (3a). Unf inner submarginal line broad, diffused and continuous, all markings broad and yellowish. Unh inner submarginal line consists of broad, straight strigæ. Above ♂ dark purple brown, paler in a side light, border narrow, but not thread-like. ♀ variable, purple blue, paling outwardly. Wings broad, rounded.

α. Below markings narrower and paler ; unf inner submarginal line becomes obsolete towards apex.

pactolus ceylonicus, Fruh. (34-38.). The Large 4 Lineblue. Ceylon. R.

β. Below markings wider and inner submarginal line unf even.

* *pactolus continentalis, Fruh.* Sikkim-Burma. NR.

γ. Below darker, markings broad and sharp; unf inner submarginal line not broader than the rest.

pactolus andamanicus, Fruh. Andamans. NR.

δ. Smaller. Above more plumbeous. Below markings narrow pale and rather obscure.

pactolus macropthalma, Fd. (32-35). Nicobars. NR.

3a (2). Unf and unh inner submarginal line consists of narrow, separate lunules ; all markings narrow, more discontinuous and whiter. Wings produced at apex F and tornus H.

3 (4). ♂ above rather plumbeous blue, violet in a side light. Unf the upper edges of the inner submarginal and outer discal lines are close together.

hermus nabo, Fruh. (30-35). The Pale 4 Lineblue. Ceylon S. India. Sikkim-Burma. NR.

H.30. Nacaduba.—(*contd.*)

v sidoma, Fruh. unh the upper discal area darkened, obscuring the lines. NR.

(3). ♂ above dark shining violet, no plumbeous tinge. Unf upper edges of the inner submarginal and outer discal lines separate.

**vajuva, Fruh.* (30-35) The Violet 4 Lineblue. Sikkim-Burma. NR.

5 (2b). Unf outer discal line meets inner submarginal line at v3, appearing as a continuous line from costa to dorsum. Below submarginal lines appear to enclose 2 rows of prominent dark spots; pale brown, markings rather broad, white and continuous. ♂ above pale blue, lines from below showing through by transparency. Much smaller; wings broad and very rounded.

* *pavana, Hors.* (26-28). The Small 4 Lineblue. Tavoy—S. Burma. Andamans. R.

6a (1a). Unf an additional pair of lines in cell near base.

6 (7a). Uph and unh 2 prominent black spots at tornus, prominently orange crowned below. Below pale grey, markings wide, submarginal lines highly lunulate. Unf basal pair of lines usually to v1. ♂ above rather pale blue. Tailed.

**ancyra, Fd.* (27-29). Felder's Lineblue. Karens—S. Burma. Nicobars. R

7a (6). ♂ uph no tornal black spots or only showing through by transparency; ♀ a single spot. Unh usually only black spot in 2 prominent, the orange crown faint and narrow.

7 (8a). ♂ apex F produced and pointed, termen straight from apex. ♂ ♀ H produced and termen straight. Tailed. Below lines pale brown and no darkening of the ground between lines; unf basal pair to v1.

a. ♂ above dark shining violet blue. ♀ plain brown, no blue; prominent black spot at tornus H and obscure submarginal white spots above. Below rather pale ochreous brown.

viola viola, M. (22-25). The Pointed Lineblue. Ceylon S. India. R.

β. As last, but below plain brown, no ochreous tinge. ♀ smalt blue, broad borders or plain brown.

* *viola merguiana, M.* Sikkim—Burma. Andamans. NR.

8a (7). ♂ apex F may be produced, but the termen is rounded at least at the apex.

8b (15a). H always tailed.

8c (12a). Unf discal lines on either side of v3 more or less straight and the spaces between not darker than the ground (except sometimes in the DSF of No. 8).

8d (10a). Wings produced, termen F straight or nearly so.

8 (9). ♂ above rather pale violet blue, markings from below showing through by transparency (except in Nicobar specimens); discs not clothed with short fine hairs (visible with a hand lens). Below all markings prominent, white. Unf markings regular, continuous and straight, submarginal lines not lunular. Unh markings very broken the usual dorsal Y, formed by the discal lines and the lines end cell, barely traceable due to the inner discal line in 3 meeting the outer line end cell; discal line in 4 separate from the line end cell. ♀ above bases pale metallic blue, disc F whitish, but never any white spots on the inner edge of the dark border in 1-3; below markings much broader and in DSF often filled in darker, forming bands.

a. Below ♂ markings broad, a distinct central whitish line showing between each pair of lines.

H. 30. Nacaduba—(*contd.*)

**atrata prominens, M.* (28-32). The Transparent 6 Lineblue. Ceylon. C.

β. Below markings narrower.

atrata euplea, Fruh. S. India. Sikkim—Burma. Andamans, Nicobars. C.

9 (8). ♂ above dark opaque shining violet blue; discs clothed with short white hairs. Below all markings much duller and narrow, more bent on F, but on H the dorsal Y is much easier to trace. ♀ disc upf metallic blue, no white, but traces of whitish spots in 1-3.

akaba gythion, Fruh. (27-31). The Opaque 6 Lineblue. Ceylon. S. India. Sikkim-Burma. Andamans. C.

10a (8d). Wings rounded, termen F highly convex; discs above covered with fine white hairs.

10 (11). ♂ above pale violet blue, all markings show through by transparency and ground colour darkens towards termen. Below markings very broad and white; unf submarginal markings highly lunulate. ♀ bases pale milky blue, discs white, whitish spots in 1-3 F. Occurs in a dwarf form, as well as the normal form.

sinhala, Ormiston. (18-30). The Ceylon 6 Lineblue. Ceylon. C.

11 (10). ♂ above dark violet blue, opaque. Below markings very dull and narrow; submarginal markings F lunulate; H dorsal Y prominent and inner discal line joins outer line end cell at their lower ends. ♀ disc upf and base H violet blue.

berenice ceylonica. Fruh. (22-30). The Rounded 6 Lineblue. Ceylon, NR.

β. Darker.

berenice plumbeomicans, WM.. (22-30). Tavoy—S. Burma. Andamans. R.

γ. ♂ above much darker purple brown. Below markings very dull and tornal ocellus H unusually large.

berenice nicobaricus, WM. (24-30). Nicobars. R.

12a (8c). Unf discal lines on either side of v3 very irregular, especially the outer upper discal line and spaces between usually filled in as dark bands.

12 (13a). Below rather dark brown, bands F broad and nearly black; H. basal bands black, discal band and band end cell coalesced to form a large black discal area. ♂ above pale shining violet blue, with a broader border, 1mm, than any other *Nacaduba*. ♂ upf lower discal area and base H pale metallic blue.

**aluta coelestis, DeN.* (23-25). The Banded Lineblue. Kumaon—N. Burma Andamans. R.

13a (12). Below bands narrow, only a little darker than the ground. ♂ above dark purple blue or purple brown with very narrow border. Below pale to dark brown with or without an ochreous tinge of varying intensity. ♀ plain brown, sometimes with a bluish lower discal patch F.

13 (14). Unf basal band confined to cell; discal band not below v2 or sometimes there is a dot in 1.

bhutea, DeN. (25-28). The Bhutya Lineblue. Sikkim—Assam. NR.

14 (13). Unf discal band continued at full width to v1 and basal band reaches v1 except in faintly marked specimens. Below very variable; may be dark brown with white lines to yellow or grey with dark bands.

**nora, Fd.* (18-25.) The Common Lineblue. Ceylon India, Burma. Andamans C.

15a (8b). H tailless. 15b (18) Unf base not darkened.

15c (17). ♂ above dark purple. Below bands darker than the ground; unh tornal spot in 2 large, much larger than the spot in 1.

H. 30. Nacaduba—(*con'd.*)

15 (16). Cilia uniform brown throughout. Very like No. 13.

a. Seasonal forms very alike; below brown, bands only slightly darker than the ground, very irregular on F. ♀ brown, base F blue or violet blue more or less. Unf basal band to v1.

dubiosa indica, Evans. (22-26). The Tailless Lineblue. Ceylon, India, C.

β. WSF as last. DSF ♀ below pale ochreous with dark bands and on H prominent marginal spots increasing in size to costa, spot at apex being as large as the tornal spot in 2; unf basal band not to v1; above plain dark brown, traces of blue scales at base F.

dubiosa sivoka, Evans; (22-26). Sikkim—Burma. C.

γ As last, but DSF ♀ below bright yellow and marginal spots H absent.
dubiosa fulva, Evans. (22-26). Andamans. C.
(*dubiosa*, Snell, is from N. Australia and is the oldest name for what is usually called the tailless form of *ardates, M.=nora*).

16 (15). F cilia white at apex. Unf basal band not below mv. Below as No. 14*a*.

a. Small and faintly marked below.
noreia noreia, Fd. (22-25). The White-tipped Lineblue. Ceylon, N. Burma. R.
β. Larger and more prominently marked below.
noreia hampsoni, DeN. (26-28). S. India—Mussoorie. R.

17 (15c). ♂ above rather pale dull violet blue, border linear. Below pale brown, bands not darker than the ground, white lines faint; F basal lines confined to cell; discal band does not extend below v2 or there is a much narrower spot in 1 set against the outer edge of the spot in 2; H tornal spots in 1a and 2 small and equal. ♀ plain brown, may have whitish discal area F.

**dana, DeN.* (24-28). The Dingy Lineblue. Ceylon. S. India. Kumaon—Burma, Andamans. N.R.

18 (15b) Unf basal ¼ black. Otherwise very like *bhuteani, DeN.* (26). De Niceville's lineblue. Karens—S. Burma. R.

H. 31. Jamides, The Ceruleans (Plate 27).

Above from milky white to deep metallic blue. Below brown with parallel white lines, filled in between as bands in the DSF forms of some species. Unf no basal lines. ♀ with broad dark border and apex F and marginal spots H.
1a (7a). Unf upper outer discal line to v3; lower outer discal line more or less joins inner upper discal line.

1b (3a). Unf upper discal lines bent in at v6. Unh discal lines broken at every vein.

1 (2). Below ochreous brown or brown, inner submarginal line not lunulate, markings dull and narrow. ♂ above brilliant dark metallic blue, border and apex F broadly black, H border narrow; borders narrower in DSF. ♀ non-metallic blue.
a. ♂ upf costa black.

bochus bochus Cr. (25-34). The Dark Cerulean. Ceylon, India, Burma, Andamans. C.

β. ♂ upf costa blue, at least at base.

bochus nicobaricus, WM. Nicobars. NR.

2 (1). Below dark grey, inner, submarginal line highly lunulate; markings white and prominent. ♂ above rather dark shining blue, border 1mm, even width. ♀ pale blue.

coruscans, M. (27-35). The Ceylon Cerulean. Ceylon. R.

H.31. Jamides—(*contd.*)

3a (1b). Unf upper discal lines not bent in at v6, but may be broken at vs. 4 and 6 ; unh markings more continuous.

3b (5a). Unf no white dashes on costa internal to the discal lines.

3 (4). Unh orange crown to tornal spot narrow, half the width of the spot. Below grey markings wide. ♂ above very pale shining metallic blue, border a thread ; ♀ nearly white.

lacteata, DeN. (28-40). The Milky Cerulean. Ceylon. R.

4 (3). Unh orange crown to tornal spot very large, twice the width of the spot, Below dark grey, markings narrow, prominent, very straight and regular. ♂ rather pale shining blue, border a thread. ♀ pale blue ; uph marginal spots very prominent and inner dark border to them very lunulate.

philatus subdita, M. (28-35). The Burmese Cerulean. S. Burma. NR.

5a (3b). Unf always 2 or 3 white costal dashes internal to the discal lines above lines end cell. Seasonal forms well marked. WSF with white lines on a dark grey or brown ground as usual. DSF filled in dark between pairs of lines, forming, broad bands, which on H may be darkened over making them indistinct, while on F the disc between the bands is more or less white. ♂ above very pale blueish white ; ♀ similar with broad dark border and apex F.

5 (6). ♂ upf border a thread and not dilated at apex ; more metallic and shining. A forest insect, not found in the open as next.

cleodus pura, M. (27-38). The White Cerulean. Assam-Burma. R.

6 (5). ♂ upf border a thread at tornus, gradually widening to 1mm. at apex.

a. ♂ above bluer and darker ; uph with submarginal spots.

celeno tissama, Fruh. (27-35). The Common Cerulean. Ceylon. C.

β. Above whiter ; uph no submarginal spots.

* *celeno celeno, Cr.* (27-40). India, Burma. C.

γ. Above as last ; uph with submarginal spots. No DSF.

celeno blairana, Evans. (27-35). Andamans. C.

δ. ♂ above with an inner fuscous border.

celeno kinkurka, Fd. (27-32). Kar Nicobar.

η. ♂ above entirely overlaid fuscous scales, leaving only a narrow pale submarginal fascia. Larger.

celeno nicevillei, Evans. (30-37). Great Nicobar and Kondul. NR.

7a (1a). Upf upper outer discal line ends at v4 ; lower discal lines join the lines at end cell ; upper discal lines angled or broken in at v6 ; inner upper discal line to v3. ♀ pale blue.

7 (8a). ♂ uph a complete submarginal row of flat spots separated from the marginal line by a white line bordering each spot. Apex F more or less produced, more so in DSF than WSF.

a. As next, but uph border more marked.

elpis meilichius, Fruh. (30-40). The Metallic Cerulean. Ceylon. C.

β. ♂ uph border broad, 1mm, slightly increasing to apex and slightly diffuse more especially at apex ; rather narrower and less diffuse in DSF. Above pale shining blue, transparent in WSF, milkier and opaque in DSF. Below WSF grey to brown ; DSF pale ochreous brown.

**elpis eurysaces, Fruh.* (30-44). S. India. Sikkim-Burma. Andamans. C.

H. 31. Jamides—(*contd.*)

γ. ♂ upl dark terminal line preceded by fuscous strigæ outwardly resting on an obsolete whitish line. ♂ above slightly shining bluish white.

elpis kondulana, Fd. (40). Nicobars. R.

8a (7). ♂ uph no submarginal markings except at tornus, where there may be traces of spots in 1a-2, border a thread. Below pale greyish brown to brown markings very narrow and sharp.

8 (9a). ♂ upf border a thread, slightly thicker than the border H. Above pale shining blue, darkening towards costa and apex F, where it is opaque, elsewhere transparent. Wings rounded, termen F more or less convex.

kankena pseudelpis But. (28-36). The Glistening Cerulean. Sikkim-Burma, NR

β. Smaller. Darker metallic blue, opaque.

kankena kankena, Fd. (28-32). Nicobars. NR.

9a (8). ♂ upf border 1mm increasing to 2mm. at apex.

9 (10). Above brilliant shining sky blue, darker than in the last two and everywhere opaque. Below darker than in last. Wings rounded and termen convex.

cærulea, Druce (32-35). Assam-Burma. The Royal Cerulean. R.

10 (9). Upf border diffused. Above dusky purple blue. Wings produced and termen straight.

lugine purpura, Evans. (35). The Dusky Cerulean. S. Burma. R.

H, 32. Azanus.—The Babul Blues. (Plate 27).

Small blues with catenulated spots below. Unh prominent black tornal spots in 1a and 2 ; basal and costal spots also black.

1a (4). Unf no spot in cell.

1 (2-3). ♂ above bright lilac blue, the scales modified in the centre of the disc F, where the blue colour appears darker, borders broad increasing at apex F and H. Below markings well developed. ♀ brown, no blue at base. Unh a basal costal brown streak.

**ubaldus, Cr.* (20-25). The Bright Babul Blue. Ceylon, India, N. Burma. C.

2 (1-3). ♂ duller violet blue, more uniform, area with modified scales present, but inconspicuous. ♀ blue at bases. Below usually markings faint.

uranus, But. (20-25). The Dull Babul Blue. India. C.

3 (1-2). As No. 2, but with broad dusky borders and darker below. Unh, no basal costal streak.

urios, Ril. (28). The Siam Babul Blue. Burma. VR.

4 (1a). Unf a spot in cell; unh prominent upper basal streak. ♂ as last above, but no modified scales. ♀ blue at bases, prominent spot end cell and whitish beyond it.

jesous gamra, Led. (21-26). The African Babul Blue. Ceylon, India, Burma. R.

H, 33. Lycænesthes.—The Ciliate Blues. (Plate 27).

Above uniform blue, no border ; ♀ brown with blue bases and dark marginal spots H. Below with broad catenulated bands. Unh prominent orange crowned black marginal spot in 2.

1 (2). Unh spot base 7 large, of the ground colour ; discal band more or less continuous. Unf discal band continuous or broken at v2. ♂ above dark purple blue. H. rounded.

α. Paler and markings below more regular.

H. 33. Lycænesthes—(*contd*)

emolus emolus, God. (28-35). The Ciliate Blue. S. India. Sikkim—Burma. C.

β. Darker, smaller. Unf discal spot in 1 inclined inwards, pointing to spot end cell.

emolus andamanicus, Fruh. (25-28). Andamans. NR.

2 (1). Unh spot near base 7 small and black; discal band broken at v6. Unf discal band broken at v3. ♂ above much paler and bluer. H produced.

α. Below paler and edges of discal bands very irregular.

lycaenina lycaenina, Fd. (24-29). The Pointed Ciliate Blue. Ceylon. S. India. R.

β. Below darker; edges of discal bands much more regular.

**lycaenina lycambes, Hew.* Sikkim-Burma. Andamans. NR.

H. 34. Niphanda.—The Pointed Pierrot. (Plate 27).

Above ♂ dark purple blue, markings from below show through faintly on F. ♀ disc whitish, prominent discal markings. Unf prominent dark streak from base along upper edge cell; spot mid cell continued to dorsum; lower part of discal band in 1 and 2 much shifted in. Unh spot base 7 and discal spots in 6 and 7 very prominently black, contrasting with rest.

α. Small, apex F and tornus H not much produced. ♂ above the blue shading to a broad fuscous margin, H with marginal spots. ♀ above no blue, white areas F and H often extensive. Unf streak from mid cell to v1 of nearly even width, upper end slightly tapered.

**fusca cymbia, DeN.* (26-30). The Pointed Pierrot. Sikkim—Dawnas R.

β. Larger; tornus H and apex F very produced. ♂ above much clearer blue and border reduced to a fine line. ♀ light blue, white beyond cell F and H. Unf streak from mid cell with lower part much enlarged. Unh spots on dorsum prominently black.

fusca tessellata, M. (30-38). Java—S. Burma. R.

H. 35. Heodes.—The Coppers. (Plate 27).

Mostly copper coloured above and spotted as *Lycaena* below.

1a (6a). H termen excavated between vs 1 and 2.
1b (3a). Unf lower discal spots 1-3 not in line, spot in 2 shifted prominently out, ground colour orange with a brown border. Upf copper red, broad border, spotted as unf. Uph dark brown with submarginal red band. Unh grey brown with reddish margin. Tailless.
1 (2). Unh spots prominent, discal series resting outwardly on a white band and the red submarginal band is bordered on both sides by black spots. Unf brown margin even and submarginal black spots complete. ♂ upf unsullied copper; ♀ basal half dark brown; uph with faint purple suffusion.

**pavana, Koll.* (37-40). The white-bordered Copper. Kashmir-Kumaon. C.
2 (1). Unh spots minute, no white band or submarginal spots; unf apex broad grey brown. Uph often with small bluish discal spots. ♂ upf more or less suffused dark scales. Very variable.
α. Small, pale. Brown suffusion usually scanty.

phlœas stygianus, But. (26-30). The Common Copper. Baluchistan—Chitral and Ladak. C.

β. Larger. Upf brown suffusion intense, leaving only the base metallic copper.

phlœas indicus, Evans (28-34). Outer Himalayas, Kashmir-Kumaon. C.

*γ. Large, pale but bright. Brown suffusion scanty: upf veins black.

H.35. Heodes.—(*contd.*)

**phlœas flavens, Ford* (30-34). Interior Himalayas to Sikkim, S.E. Thibet. C.

3a (1b). Unf lower discal spots in 1-3 in line.

3 (4a). Unh reddish brown with 2 narrow discal pale lines, pale line end cell and 2 or 3 basal black spots ; markings very obscure. Above ♂ shining purple with dark border and prominent spot end cell, marginal orange lunules at dorsum F and along margin H. ♀ above dark brown, outer area F orange with blue-edged black spots. Unf orange with blue edged black spots. Tailless.

**tseng mandersi, El.* (31-35). The Chinese Copper. Shan States. VR.

4a (3). Unh white, prominently spotted.

4 (5). Unf spot in 2 in line with spots in 1 and 4 ; white, more or less overlaid yellow. ♂ above brilliant golden copper, unspotted and border 1mm., widening at apex and macular on H. ♀ yellow, fully spotted, base F and entirely on H suffused dark scales. Tailless.

**solskyi aditya, M.* (32-36). The Golden Copper. Chitral—Ladak. R.

5 (4). Unf spot in 2 in line with spot in 1 and spot end cell. Below both wings white with a somewhat diffused submarginal reddish band. Tailed. ♂ above purple brown basal two thirds purple glossed, spots from below show faintly on F and end cell H ; ♀ dark brown, upf outwardly more or less orange and with orange marginal spots H.

phoenicurus, Led. (28-35). The Baluchi Copper. Baluchistan. R.

6a (1a). H termen evenly rounded.

6 (7). Unh white with prominent and regular spots and a red submarginal band spotted on either side. ♂ ♀ above purple brown, basally purple glossed, upf with a spot end and mid cell. Unf orange discal spots small, regular, becoming obsolete posteriorly ; submarginal spots small.

a. Tailed. Paler above and below.

casyapa susanus, Swin. (29-35). The Purple Copper. Baluchistan. R.

β. Tailless. Darker above and below.

**casyapa evansii, DeN.* Chitral. R.

7 (6). Unh entirely verdigris green, spotless or with very tiny basal and discal spots. Unf orange with green border ; in ♂ the orange area partly or wholly suffused green ; discal spots in pairs in echelon, but upper pair shifted right in. Above ♂ bright copper, border, 1½mm., inwardly suffused purple ; upf fully spotted and uph prominent spot end cell and discal row. ♀ dark brown, upf more or less orange outwardly. Tailless.

kasyapa, M. (30-36). The Green Copper. Chitral—Mussoorie. NR.

v. zariaspa, M. (27-32). ♂ above much duskier and entirely suffused purple ; upf spots smaller and regular, the lower discal spots not elongated as in typical form and never a spot base 2. ♀ darker, less orange F. Below much bluer. NR.

H. 36. Heliophorus.—The Sapphires. (Plate 26).

Below ochreous with a broad red border H. H usually tailed at v2 or at least toothed.

1 (2a). Unh prominent costal and dorsal black spots near base. ♂ above dark shining violet with a broad border F and red submarginal band H. ♀ dark brown, the red submarginal fascia continued on F. Below pale ochreous to ochreous brown, a prominent white line inside the red submarginal area. Tailed

H. 36. Heliophorus—(*contd.*)

**sena, Koll.* (28-33). The Sorrel Sapphire. Chitral—Kumaon. C.

2a (1). Unh no prominent basal spots (may be minute ones in No. 2). ♀ above dark brown with a broad orange upper discal fascia on F and a red submarginal band on H.

2 (3a). Below no markings beyond sometimes a few dots between the base and the red marginal area, which is very dark and continued on to apex F. ♂ above dark shining purple. Tailed.

a. Very variable. ♂ upf border broad, over 1½mm.; often with an orange area beyond the cell; uph purple much restricted and red margin very prominent. ♂ F apex sharp and termen straight.

epicles indicus, Fruh. (28-34). The Purple Sapphire. Kumaon—Dawnas, Middle Andamans. C.

β. ♂ upf border narrow, 1mm. and uph orange markings reduced. ♀ upf orange band wider. ♂ apex F more rounded.

epicles kohimensis, Tyt. Nagas. NR.

3a (2). Below with a dark discal line and a line end cells, usually obsolete on H, but at least line end cell on F is traceable; red margin not continued to F and tornal spot F prominent.

3 (4a). H no tail, only a tooth at v2. ♂ above deep rich, non-metallic blue, border broad, but varies with season. Unf discal line straight and macular, if present. ♀ unf a large irrorated orange discal patch.

tamu, Koll. (30-35). The Blue Sapphire. Chitral—Kumaon. NR.

4a (3). H with long tail; ♀ unf no orange patch.

4 (5-7). ♂ above brilliant metallic green: inner edge dark border F straight.

a. ♂ metallic green with no bronzy tint.

androcles coruscans, M. (30-35). The Green Sapphire. Kashmir-Kumaon, N.R.

β. ♂ with a more bronzy tinge.

androcles androcles, Hew. Assam. N. Burma. N.R.

5 (4, 6, 7). ♂ brilliant metallic blue: inner edge dark border F curved.

* *moorei moorei, Hew.* (30-35). The Azure Sapphire. Chumbi, Bhutan. NR.

β. Duller.

moorei birmana, Fruh. (32-36). Manipur—N. Burma at high elevations N.R.

6 (4, 5, 7). ♂ above powdered dark metallic green scales.

a. Upf green colouring as extensive as in No 4.

viridipunctata viridipunctata, DeN. (34-40). The Powdery Green Sapphire. Kumaon—Sikkim. NR.

β. Upf green colour much restricted.

viridipunctata kala, Tyt. Nagas. NR.

7 (4-6). ♂ above iridescent golden bronzy.

brahma, M. (32-38). The Golden Sapphire. Kumaon—N. Burma. NR

H. 37. Neolycæna.—The Persian Hairstreak.

Above dark brown, cilia chequered. Below brown. Unh with irregular white discal and postdiscal streaks; 2 rows of black submarginal dots, white margined inside and yellowish between the rows. Very like an ordinary *Lycaena* in general appearance.

sinensis, Alph. (32-34). The Persian Hairstreak. Baluchistan. VR.

H.38. Callophrys.—The Tailless Hairstreaks.

1 (2,3). Below dull green with a row of small obsolescent discal white spots on H. Above plain dark brown.

rubi, L. (28-32). The Green Hairstreak. Baluchistan—Chitral. R.

2 (1, 3.) Below bright ferruginous, base, H darker; a narrow irregular dark discal line. Above rather pale blue with a broad dark border and apex F.

leechii, DeN. (30). The Ferruginous Hairstreak. Assam. VR.

3 (1, 2). Below dark brown with dark lines across base H, ends cells and 2 across disc, also submarginal diffused line H. Above plumbeous blue.

chalybeia, Leech. (28-32). The Plumbeous Hairstreak. N. Burma. VR.

H.39. Strymon.—The White-line Hairstreaks. (Plate 26).

Above dark shining brown. Below pale to dark brown, a narrow discal white line across both wings, inwardly black edged; a more or less obsolete series of black submarginal spots, inwardly white edged and a subterminal white line; H tornal lobe and spot in 2 black, prominently crowned orange.

1 (2). H single tail at v3. Unh discal line regular; submarginal spots H. obsolete on H and on F only in 2 and 3.

**sassanides, Koll.* (28-35). The White Line Hairstreak. Baluchistan—Chitral—Mussoorie. NR.

2 (1). H tailed at vs 2 and 3. Unh white discal line distorted to a W near dorsum.

mackwoodi, Evans. (34). Mackwood's Hairstreak. Manipur, N. Shan States. VR.

H.40. Listeria.—Lister's Hairstreak. (Plate 26).

♂ above bright blue, very broad black apex F; ♀ duller. Unf smoky brown, outer ¼ broadly paler and bearing an obscure wide fascia; a pale spot end cell. Unh basal ¼ black, rest reddish brown, very obscurely marked.

**dudgeoni, DeN.* (26-28). Lister's Hairstreak. Mussoorie—Sikkim. VR.

H.41. Euaspa.—The Water Hairstreak. (Plate 26).

♂ ♀ above rather pale blue, broad black apex F and an upper white discal patch F and H. Below dark chocolate brown, broad whitish border and marginal white ringed spots, orange circled at tornus H. Lobe small.

**milionia, Hew.* (30-34). The Water Hairstreak. Murree—Kumaon. NR.

H.42. Thecla—The Hairstreaks. (Plate 26).

Mostly metallic green above in ♂. ♀ blue purple or brown with 2 orange or white discal spots on F. Below usually with dark edged white lines and more or less prominent tornal orange and black spots H. All tailed except No. 17.

1a (5, 6a, 12a). ♀ upf basally purple with 2 orange discal spots, end cell and mid 3; uph plain dark brown.

1b (3a). ♂ above dark powdery green, or dull purple; upf black border 3mm., vs black. ♀ purple colour confined to base, orange spots small. Below brown to ferruginous with broad dark bands consisting of a bar end cell, discal band, marginal and submarginal bands; discal bands more or less edged outwardly by a silver line.

1 (2). Unh discal band very broad, coalesced to bar end cell, outwardly silver edged, straight to v2, then zigzagged to dorsum; innner submarginal band lunulate; prominent orange crowned tornal spots. Below rather pale brown, bands dark brown. Unf discal band straight and increasing to costa. Above dark powdery green. Wings produced. ♀ purple absent.

icana, M. (40-45). The Dull-green Hairstreak. Kulu—Kumaon. R.

2 (1). Unh discal band narrow and quite separate from the bar end cell; inner submarginal band lunulate. Below markings ferruginous; unf discal band of even width. Above purple. Wings rounded.

H. 42. Thecla—(*contd*).

a. Below ochreous brown, discal band outwardly silver edged and on F angled at v3 ; on H straight to v2, thence zigzagged to dorsum ; tornal spots traceable, but very obscure.

**bieti dohertyi* DeN. (40-45). The Indian-purple Hairstreak. Kulu-Garhwal. R.

β. As last, but upf base only violet and uph all dark brown.

bieti mandara, Doh. (40). Kumaon. VR.

γ. ♂ above as *a*, but darker purple. Below very dark brown, silver edging to discal band obsolete ; discal band on F evenly curved and on H only slightly zigzagged at lower end ; all markings very deep ferruginous and tornal spots H absent.

bieti irma, Evans. (38). Bhutan. R.

3a (1b). ♂ not dull or purple green. Unh tornal orange spots prominent. Wings rounded.

3 (4). ♂ marked like ♀ ; upf peacock purple with broad dark brown apex and termen and 2 small yellow discal spots. ♀ duller, orange spots much larger, coalesced. Unf dark brown, powdery purplish white discal band, inwardly silver edged and a submarginal white line ; in ♀ orange discal spots show as above. Unh dark brown base, broad irregular discal band, and broad submarginal band powdery purplish white.

**pavo, DeN*. (35-38). The Peacock Hairstreak. Bhutan—Nagas. VR.

4 (3). ♂ above metallic green. ♀ as ♂ of last. ♂ below silver white, no submarginal markings, dark bar end cells, narrow brown discal band often obsolete on F, and irregular dark brown central markings on H, often obsolete. ♀ unf pale brown, dark discal and submarginal markings, separated by a broad silver band ; unh as ♂ but markings broader and silver ground, especially towards base, tending to become pale brown.

a. ♂ upf black margin 2mm. to 5mm. at apex.

**ataxus ataxus, Db.* (40-46). The Wonderful Hairstreak. Murree-Kumaon. R.

β. ♂ upf borders much narrower.

ataxus zulla, Tyt. Nagas. VR.

5 (1a. 6a. 12a.). ♀ above metallic sky blue, very faint traces of orange discal spots upf and borders broad. ♂ above bronzy metallic green with a violet sheen, border, 1½mm to 5mm at apex ; uph a terminal blue line dorsum-v3. Below dark brown with silver white lines ; unf line end cell, discal line and 2 submarginal lines ; unh line through mid cell to v8, discal line very zigzag at lower end, submarginal and diffused marginal lines, tornal orange spots prominent.

suroia, Tyt. (40-42). Manipur. The Cerulean Hairstreak. Manipur. R.

6a (1a-5-12a). ♂ upf dark brown, upf with a large coalesced orange discal spots in mid 3 and end cell, spot in 3 often continued into 2. Below pale to dark brown ; unf silver or pale edged dark bar end cell, dark discal band, outwardly silver or pale edged, 2 whitish submarginal lines ; unh similarly marked and margin powdered whitish scales, tornal spots prominent and area between discal and submarginal lines often pale brown or white powdered.

6b (9a). Unh basal line mid 7 present, though often obscure.

6 (7a). Unh basal line in 7 crosses cell, but cell portion may be obsolete especially in ♀; upper end bar end cell nearer basal than discal line. ♀ unf orange spots show prominently and in ♂ there are some obscure orange scales in middle of cell bar. Below dark brown, area between discal and submarginal lines prominently silver powdered. ♂ above metallic green, border 1½ mm.

H. 42. Thecla—(*contd.*)

vittata, Tyt. (41-44). Tytler's Hairstreak. Manipur—Nagas. R.

7a (6). Unh basal line does not enter cell ; upper end cell bar much closer to discal line. ♀ unf no traces of orange spots.

7 (8). Above ♂ metallic green ; border 1-2mm., sharp defined.

a. Unh basal area pale, same shade as area between discal and submarginal lines.

duma duma, Hew. (42-48). The Metallic Green Hairstreak. Sikkim—Nagas. NR.

β. Unh basal area dark, same shade as between marginal pale area and submarginal line.

* *duma dumoides, Tyt.* (44-48). Manipur. NR.

v. intermedia, Tyt. (38-44). Smaller and ♂ border F narrower.

8 (7). Above ♂ powdered dark green scales, border 4mm., meeting black apex at v4 (Manipur, at v6 in Sikkim). Below uniform very dark brown, silver discal line prominent, remaining markings obscure and pale postdiscal areas absent.

zoa, DeN. (42-46). The powdered Green Hairstreak. Sikkim—Manipur. R.

9a (6b). Unh basal silver line absent.

9 (10a). Above ♂ powdered dark green scales, border 4mm., meeting black apex at v6. Very like No. 8, but paler below and smaller.

doni, Tyt. (36). The Suroifui Hairstreak. Manipur. VR.

10a (9). Above metallic green with sharp defined border.

10 (11). Below uniform brown, areas between discal and submarginal lines not conspicuously paler. ♀ above as *ataxus.*

letha, Wat. (40). Watson's Hairstreak. Assam. Chin Hills. VR.

11 (10). Below silvery fawn colour, area between submarginal and discal lines conspicuously paler, nearly white, silver lines absent. Uph ♂ terminal metallic blue scales dorsum-v3.

kabrua, Tyt. (36-40). The Kabru Hairstreak. Manipur, Nagas. R.

12a (1a-5-6a). ♀ above more or less rather pale blue with 2 large whitish spots end cell and mid 3. Below grey brown to silvery bluish marked as in last group.

12b (18). ♂ metallic green with well defined black border.

12c (17). H tailed.

12d (15-16). Unh discal band straight and continuous from v2 to costa.

12 (13-14). Below grey brown, not silvery. ♂ above border even and broad, 2mm., F and H. ♀ only traces of blue on F and H all dark brown. Below markings very even ; H tornal orange spots prominent.

birupa, M. (38-40). The Fawn Hairstreak. Simla—Kumaon. NR.

13 (12-14). Below greyish white, not silvery. ♂ above border F as last, H narrower and irrorated bluish scales. ♀ blue colour extensive F and H. Unh markings pale and diffuse, no tornal orange spots H.

jakamensis, Tyt. (40-42). The Jakama Hairstreak. Manipur, Nagas. R.

14 (12-13). Below bluish silvery. ♂ F border narrower, even.

a. Larger. ♂ border H as broad as on F and no blue scales on it. ♀ H blue colour much restricted.

H. 42. Thecla—(*contd.*)

* *syla syla, Koll.* (42-45). The Silver Hairstreak. Safed Koh. Chitral—Kumaon. C.

β. Smaller. ♂ border H narrower than on F and irrorated blue scales. Below markings narrower, tornal orange spots H obscure. ♀ uph blue colour extensive, usually to termen.

syla assamica, Tyt. (36-38). Sikkim—Manipur. R.

15 (12d-16). Unh discal line very irregular, much bowed out opposite end cell. ♂ above margin very narrow. ♀ and below as No. 14 *β*.

kirbariensis, Tyt. (36-38). The Kirbari Hairstreak. Manipur, Nagas. R.

16 (12d-15). Unh discal line broken into semi-detached streaks, bowed in opposite end cell. Unf discal line also of detached streaks. ♂ ♀ above as No. 15, but uph with a blue terminal line on either side of tail.

paona, Tyt. (46-47). The Paona Hairstreak. Manipur. VR.

17 (12c). Tailless. ♂ ♀ above as No. 15, border in ♂ broader. Below as No. 16, markings smaller and often obscure ; no tornal orange markings.

khasia, DeN. (36-38). The Tailless Metallic Green Hairstreak. Assam—Manipur and Nagas. R.

18 (12b). ♂ as ♀. Tailed. Above blue colour extensive ; H margin narrow, containing a narrow pale blue line running along entire termen. Below white, not silvery ; F discal band black, also submarginal band, which ends in 2 very large spots in 1 and 2 ; other markings pale brown ; H tornal orange spots prominent.

* *ziha, DeN.* (35-38). The White-spotted Hairstreak. Murree—Kumaon. R.

H. 43. A Chaetoprocta.—The Walnut Blue. (Plate 26).

Above ♂ ♀ dark shining purple, border and apex broadly black, broader in ♀. Below white, marked as in H. 42-14 ; bands on H and end cell F pale and obscure ; discal band F black also marginal spots F, that in 1 being very large. ♀ with a prominent tuft of closely set yellow hairs at end of abdomen. Lobe fairly well developed and H angled at v3.

* *odata, Hew.* (32-36). The Walnut Blue. Chitral—Kumaon. C.

H. 43 B. Amblopala. The Chinese Hairstreak.

Above ♂ ♀ metallic blue with broad dark brown borders and an orange discal spot in 4-5 F. Unf pale brown, apex and margin chestnut, a silver bar end cell and a silver discal line. Unh chestnut, a central silver Y band from mid costa to tornus.

avidiena, Hew. (32). The Chinese Hairstreak. Naga Hills, VR.

H. 44. Curetis. The Sunbeams. (Plate 27).

♂ golden red above : ♀ with red or white discal areas. Below silvery white with obscure bands.

1a (4a). Below not covered with minute black dots. Unf discal and submarginal bands parallel. Unh discal band far from end cell. ♂ upf black border not or only very slightly continued along the dorsum. H only slightly produced and termen rounded.

1b (3). ♀ above with broad white discal patches.

1 (2). ♂ above copper of a pale tint : upf dark border very narrow, often reduced to a thread at dorsum and angled at the apex more or less. Below postdiscal line on both wings fairly straight and regular.

H. 44. Curetis—(*contd.*)

phœdrus, F. (40-48). The Malabar Sunbeam. Ceylon. S. India—Bengal. NR.

2 (1). ♂ above darker : upf dark border broader and more even. Below postdiscal line separately curved in each space and varies in distance from base ; unh line on either side of v5 markedly nearer the margin.

thetis, Dry. (40-48). The Common Sunbeam. India, Burma. NR.

3 (1b). ♀ with orange or obscure whitish discal areas. ♂ above with broad, evenly curved, dark border. Unf postdiscal lunules in 5 and 7 well beyond the others and not in line with rest as in No. 2.

a. ♀ with orange areas. Always larger than *β*.

saronis gloriosa.M.(44-48). The Burmese Sunbeam. Cachar—Burma. NR.

β. As last, but smaller.

saronis saronis, M. (40-44). Andamans. NR.

γ. ♂ as last. ♀ with obscure whitish discal areas.

saronis nicobarica, Swin. (40-44). Nicobars. NR.

4a (1a). Below covered with minute black dots. ♂ upf border continues along dorsum.

4 (5a). F termen convex and H termen rounded. ♂ uph base and tornus broadly darkened. ♀ with broad orange areas, which are darker and more restricted than usual : on H bar end cell not showing and the red area usually does not reach the costa. Below discal and submarginal bands nearly parallel.

sperthis, Fd. (30-40). The Rounded Sunbeam. Mergui. R.

5a (4). F termen straight or concave and H tornus produced. Unf discal and submarginal bands convergent to apex.

5 (6). ♀ with orange discal areas. Unh portion of discal band in 6 and 7 variable, but not in line with bar end cell.

a. ♂ above very variable and difficult to distinguish from No. 6 : darker and usually no tooth end cell upf : uph base darkened, leaving a red discal area, which narrowly reaches the costa, as a rule.

bulis bulis, Db. (35-45). The Bright Sunbeam. Mussoorie—N. Burma. R.

β. ♂ much brighter : uph all red with a prominent black streak from the base over the mv : ends veins black.

* *bulis malayica, Fd.* (40-45). Karens—S. Burma. NR.

6 (5). ♀ with white discal areas of variable extent. Unh the portion of the discal band in 6 and 7 in line with the bar end cell, seen best by transparency from above. ♂ above paler red than usual and usually a tooth end cell upf. F apex very produced and may be falcate : tornus produced and termen straight or concave. H tornus much produced and termen produced in middle, being sharply angled at v4.

acuta dentata, M. (40-50). The Angled Sunbeam. S. India. Central Provinces. Mussoorie—Burma. C.

H. 45. Iraota.—The Silverstreak Blue. (Plate 27).

Above bright shining blue with broad borders. Below dark ferruginous; unf a silver streak and discal spots ; unh usually a broad irregular basal silver streak, obscure zigzag discal markings and usually ochreous towards termen.

1 (2). ♂ tail only at v1 ; ♀ also tail at v2 ; margin more or less crenulate. Unh silver streak never to margin and sometimes completely absent. ♀ purple with broad borders.

H. 45. Iraota—(*contd.*)

a. ♂ above green rather than blue ; unh silver streak, when present, clouded ferruginous.

timoleon nicevillei, But. (40-48). The Silverstreak Blue. Ceylon. R.

β. ♂ above blue. Unh silverstreak, if present, clear.

* *timoleon timoleon, Stoll.* S. India—Mussoorie—Burma. NR.

2 (1). ♂ tail at vs 1 and 2 ; ♀ with an extra tail at v3. ♂ above deeper blue ; ♀ entirely dark brown. Below silver markings more extensive and wider ; F discal spot in 4 elongate, nearly to termen ; H a basal streak along costa and usually the broad irregular streak reaches termen and throws down a bar across end cell ; discal zigzag silver markings prominent, margin broadly pale ochreous.

rochana boswelliana, Dist. (40-48). The Scarce Silverstreak Blue. Manipur—Burma. R.

H. 46. Horsfieldia.—The Leaf Blue. (Plate 27).

Above blue or purple with dark borders. Below dark ferruginous in ♂, rather pale brown in ♀, with a prominent black discal line across both wings, more or less irrorated with dark scales, presenting a leaflike appearance as in *Kallima.*

1 (2). ♂ above purple with border of even width.

a. Smaller and darker. ♀ in 2 forms, typically smalt blue to purple.

anita naradoides, M. (42-52). The Purple Leaf Blue. Ceylon. NR.

♀v. *darana, M.* Above plain brown. R.

β. Larger. ♀ above smalt blue. ♂ above border narrower.

**anita anita, Hew.* (50-55). S. India. Sikkim—Burma. NR.

γ. ♂ bluer above and darker below. ♀ blue area larger and extending to H.

anita andamanica. Ril. (50-55). Andamans. NR.

2 (1). ♂ above rich deep blue ; ♀ purple blue, always more extensive, especially on H. ♂ above border narrows to dorsum.

narada taooana, M. (50-55). The Blue Leaf Blue. Dawnas—S. Burma. R.

H. 47. Thaduka.—The Many-tailed Oakblue. (Plate 27).

a. ♂ ♀ above pale silvery blue, black border=½ the wing F and H. Below base F and all H very dark brown, outer half F pale brown, with a discal band of black spots ; H spotting very obscure ; a prominent white spot mid cell F and usually some metallic green spots at bases F and H and above the tails.

**multicaudata kanara, Evans.* (35-45). The Many-tailed Oakblue. S. India. R.

β. Above darker, Unf cell spots and unh spot base 7 dark.

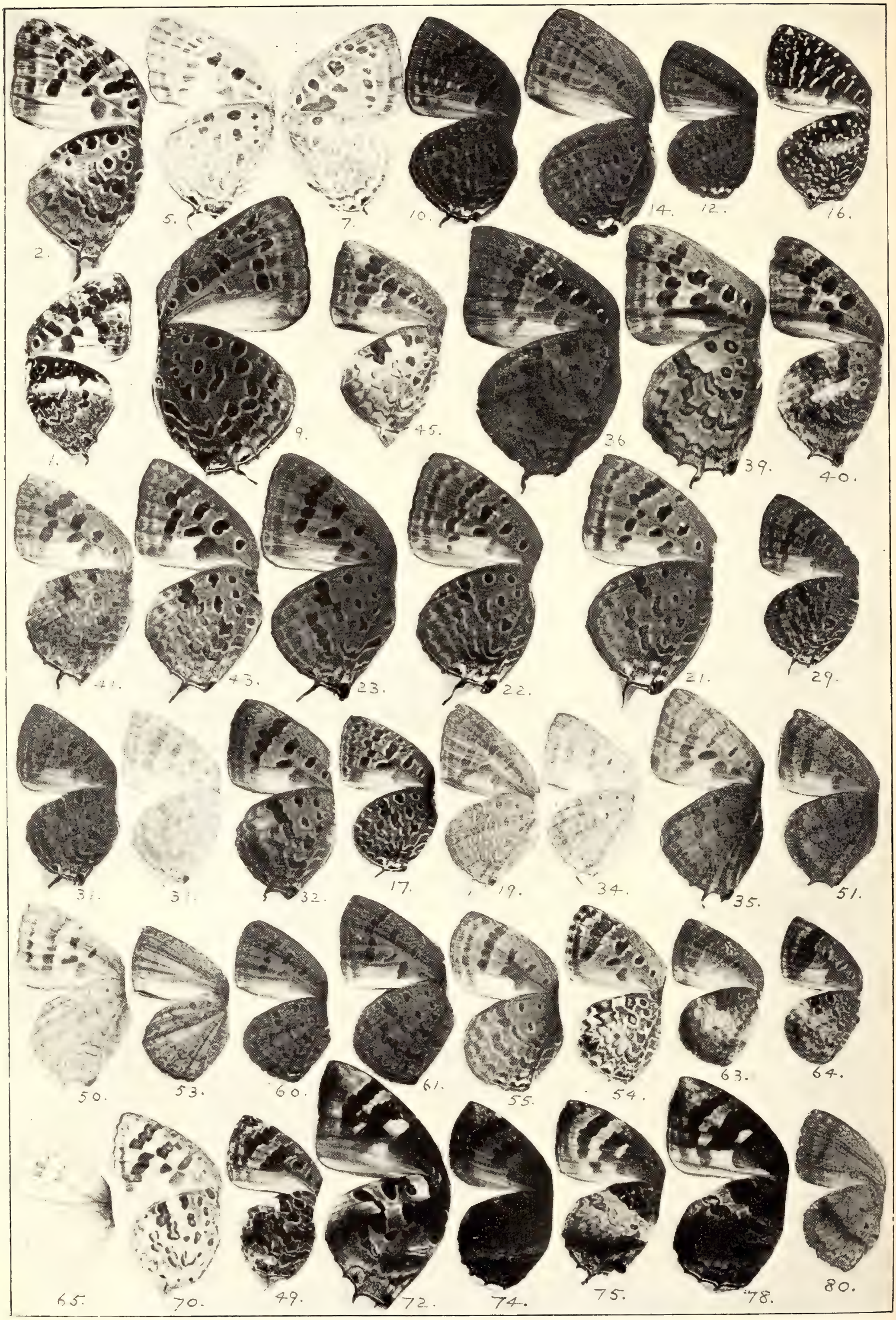
multicaudata multicaudata, M. S. Burma. R.

H. 48. Mahathala.—The Falcate Oakblues (Plate 27).

1 (2). H margin smooth. ♂ above rich deep blue with narrow borders: ♀ purple with broad borders. Below rufous brown, markings obscure : F white lines across cell and a broad continuous dark discal band; H a pale fascia from mid dorsum to apex and a similar submarginal fascia, obscure spots at base.

**ameria, Hew.* (38-42). The Falcate Oakblue. Bengal—Burma. R.

2 (1). H margin crenulate. ♂ ♀ above blue with broad borders and black veins ; costa upf chequered black and white. Below pale to dark brown ; H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H. **Lycaenidae.** H. 49. *Amblypodia.*

H. 48. Mahathala—(*contd.*)

with obscure confused markings as in H. 47 ; F with 6 white bars across the cell, a highly waved postdiscal line and a square large pale patch mid 1, with 2 smaller square spots in 2 and 3 ; H some tornal metallic green scales.

**atkinsoni, Hew.* (35-40). The Crenulate Oakblue. Manipur—S. Burma. R.

H. 49. Amblypodia.—The Oakblues. (Plate 28).

Above all shades of blue and purple and even metallic green. Below normally with the same pattern. Unf 3 spots in the cell, including the spot at the end of the cell; often with a costal spot in 10 over the spot end cell and more rarely with one or more spots nearer the base in 11 and at the bases of 10 and 11 ; a more or less continuous discal band, which may be broken at v4 and may or may not be continued to v1 ; a spot at base 2 and a dark area at base 1 ; a submarginal dark line. Unh a more or less prominent spot or half spot at base 8 ; a basal row of 4 spots (7, cell, 1 and dorsum) ; a central row of 3 spots (7, cell and 2); a continuous band made up of spots from the costa to dorsum, the shape of which varies in different groups, more especially as to the shape and position of the two uppermost spots (in 7 and 6), whether the dislocation at v2 is partial or complete and whether the band runs continuously to the dorsum or not ; more or less prominent tornal green or blue metallic scales and a single broad or 2 narrow submarginal lines. May be tailed at v2 and lobed at the tornus H.

1a (72a). Unf with 3 normal dark cell spots.

1b (16a). Unh with the discal spots in 7, 6 and 5 with their centres in line, more or less rounded ; spots in 7 and 6 in echelon, inner edge of spot in 6 more or less in line with the outer edge of the spot in 7 (see also Nos. 27 and 28). Tailed or tailless.

Anthelus Group.

1c (11a). Tailed.

1d (4a). Unf cell spots abnormal, not confined to cell; discal band broken at v4. Unh tornal green scales diffused, lobed. H produced.

1 (2-3). Unf spot end cell extended to costa and 3 prominent whitish costal spots, including upper spot of discal band ; unh discal band completely broken at v2 and continuous to dorsum. Below chocolate with on H a broad white band from base cell to apex and below this band the ground colour is much paler. Above ♂ ♀ pale blue, border F ½mm. at tornus to 5 at apex, H no border.

**subfasciata, M.* (40-46). The White-banded Oakblue. Dawnas—S. Burma. NR.

2 (1-3). Unf basal and central spot extended to v12 and 2 prominent costal spots ; unh an additional costal spot at base 8, discal band partially broken at v2 and discontinuous to dorsum. Below ochreous brown, spots on F and about costa H very dark. ♂ above metallic blue changing to purple, border F ½mm. at tornus to 3 at apex ; ♀ paler metallic blue, borders broad ; tornus H fuscous.

a. Above paler. Below pale ochreous. Unh other than costal spots obscure.

**anthelus anthelus, Db.* (50-60). The Multi-spotted Oakblue. Dawnas. NR.

β. Above and below much darker. Unh all markings prominent.

anthelus anthea, Evans. Tavoy—S. Burma. NR.

3 (1-2). Unf central cell spot only extended to v12 and a single costal spot in 10 over spot end cell; unh discal band completely broken at v2 and continuous to dorsum. Below pale ochreous brown, spots large, rounded and only slightly darker than the ground, apex and outer part of H may be whitish. ♂ above pale metallic blue changing to violet, no border ; ♀ more violet, border broad and a spot at end cell F.

anarte*, *Hew. (62-65). The Magnificent Oakblue. Manipur—S. Burma. VR.

H. 49. Amblypodia—(*contd.*)

4a (1d). Unf cell spots normal and at most a single costal spot.

4 (5a). Below rosy purple. Unf discal band continuous or slightly broken at v2, no costal spot. Unh discal band partially broken at v2 and continuous to dorsum, tornal green scales diffused. ♂ above dark purple blue, border F ½mm.; uph costa broadly fuscous: ♀ with broad borders.

suffusa, Tyt. (40-50). Tytler's Rosy Oakblue. Manipur-Dawnas. R.

5a (4). Below brown or ochreous brown.

5b (10). ♂ upf no discal area of modified scales. Unf discal band completely broken at v4; unh discal band partially dislocated at v2 and more or less continuous to dorsum.

5c (9). Unf no costal spot in 10 over spot end cell.

5d (8). Unf discal spots separated by white irides. Below pale brown with large prominent spots. Unh tornal green scales diffused; lobed.

5a (7). Above ♂ pale violet blue, border a thread, a black spot end cell surrounded by a white area. ♀ paler, becoming whitish outwardly, spot end cell and a spot beyond conjoined to the costal border. Unf discal spots in 2 and 3 elongated towards the spot end cell.

5 (6). Unf discal spots well separated.

a. Pale and large. Below markings small in DSF, being very black on F and about costa H.

camdeo camdeo, M. (52-56). The Lilac Oakblue. Sikkim—N. Burma. R.

β. Smaller and darker. ♀ more uniform violet blue.

**camdeo varro, Fruh.* (42-50). Karens—S. Burma. VR.

6 (5). Unf discal spots large with irides conjoined.

dispar, Riley. (44-52). The Siam Oakblue. Assam—Dawnas. VR.

7 (5a). ♂ above pale silvery metallic blue, border 0 to 1mm. at apex.

♀ bluish white, border broad and a spot end cell. Unf spots in 2 and 3 rounded; unh whitish below costa inside the discal band.

**karennia Evans.* (48). The Karen Oakblue. Karens. VR.

8 (5d). Unf discal spots not separated by white irides, upper spot of discal band shifted in. Below rather dark brown, all white edgings prominent. ♂ pale silvery violet blue, no border, a more or less prominent discal white spot upf. ♀ darker and border broad: spot end cell, not joined to costal border.

opalina, M. (48). The Opal Oakblue. Assam—Tavoy. VR.

9 (5d). Unf costal spot in 10 over cell spot in continuation of upper spot of discal band, no spot in 1. Below hair brown, irides pale brown, not prominent; ♂ above metallic violet blue, no border; ♀ violet blue, borders broad, no spot end cell. Unh tornal green scales sharp defined.

agnis, Fd. (56-58). The Large Metallic Oakblue. Dawnas—S. Burma. R.

10 (5b). ♂ upf with a discal area of modified scales. Unf discal band variable, may be broken at v4, only sinuous, or spot in 4 may be shifted out; usually costal spot in 10. Below hair brown, markings dull; unh discal band completely dislocated at v2 and continuous to dorsum; tornal green scales sharply defined, lobed. ♂ above metallic violet blue, becoming violet outwardly; ♀ with broad borders, no spot end cell, but with ill-defined spots beyond conjoined to the costal border.

a. Paler and more silvery, border F in a thread.

H. 49. Amblypodia—(*contd.*)

atosia aricia, Stg. (42-46). The Tailed Disc Oakblue. Pegu Yoma—Karens. R.

β. Darker, border F in ♂ ¼mm.

* *atosia atosia, Hew.* Dawnas—S. Burma. C.

11a (1c). Tailless. Below hair brown, markings dull ; unf no spot in 1 and costal spot obscure or absent : unh lobed and tornal green or blue scales sharply defined. ♂ border broad, no spot end cell, but may be spots beyond joined to the costal border. Wings rounded and costa F highly arched.

11b (13a). Unh discal band completely dislocated at v2 and continuous to dorsum. Below more or less obscurely purple washed.

11 (12). Unf costal spot in 10, discal band broken at v4 and usually spot in 4 shifted out. ♂ ♀ above as in No. 10, but border F in ♂ up to 1mm. (Paler and bluer than typical *epimuta* from Java).

epimuta elsiei, Evans. (37-43). The Tailless Disc Oakblue. Tavoy—S. Burma. NR.

12 (11). Unf costal spot in 10 obscure or absent, discal band bent at v4 and spot in 2 shifted out ; darker below. ♂ above shining metallic blue, completely overlaid violet on F, border F 1¼mm.

* *metamuta, Hew.* (36-40). The Bicolor Oakblue. Karens—S. Burma. R.

13a (11b). Unh discal band partially dislocated at v2, more or less continuous to dorsum. Unf no costal spot in 10 ; discal band bent at v4.

13 (14-15). ♂ above pale metallic blue shading to violet, border F ½mm. Small.

payaiensis, Ollen. (38-40). The Pale Arched Oakblue. Dawnas—S. Burma. R.

14 (13-15). ♂ above darker and much larger.

* *moolaiana, M.* (42-50). The Large Arched Oakblue. Karens—S. Burma. R.

15 (13-14). ♂ above dark uniform violet blue, ♀ uph, border broad. Below darker and markings more prominent.

15a (15b). Border F 1 mm.

agesilaus, Stg. (43). The Dark Arched Oakblue. Mergui. VR.

15b (15a). Border F a thread.

amphimuta, Fd. (43). The Malay Arched Oakblue. Mergui. VR.

16a (1b). Unh discal spots in 7, 6 and 5 with centres not in line, 7 and 6 more or less quadrate, conjoined. (See Nos. 27 and 28).

16b (65-a). Unf no spot base 11 between basal and central cell spots.

16c (36a). Unh discal band completely dislocated at v2 and usually continuous to dorsum. Always tailed and F termen never concave just below the apex ; lobed.

16d (21a). Unf discal band completely broken at v4, spot in 4 being shifted out of line with the rest ; usually a well defined costal spot in 10 and often spot in 11 and at base of 7 and 10. Unh tornal green scales prominent, though sometimes diffuse.

Atrax Group.

16 (17a). Below dark chocolate, all markings broken up and consisting of small white lines and dashes. Unh discal spot in 6 large, overlapping spot in 5 and end cell, outwardly concave. ♂ above pale metallic silvery blue shading to violet at apex F, border ½mm. ; ♀ pale blue with broad borders F.

H 49. Amblypodia.—(*contd.*)

* *albopunctata, Hew.* (34-38). The White Spotted Oakblue. Karens—S. Burma. NR.

17a (16). Below grey brown to ochreous or purple brown with a purple to pinkish wash. Unh discal spots in 7 and 6 conjoined and placed between spot end cell and spot in 5.

17 (18-20). ♂ above dark shining purple blue, border F 1½mm. to 3 at apex ; ♀ shining blue, border F 2mm. to 5 at apex, costal border 1mm. leaving blue over cell, a black area beyond cell conjoined to black apex. Below very distinct, dark purple brown with prominent white edged broad markings, more irregular than usual ; F costal spots prominent ; 2 zigzag submarginal lines. Wings rounded.

* *alitaeus mirabella, Doh.* (36-38). The Purple Brokenband Oakblue. Tavoy—S. Burma. R.

18 (17-19-20). ♂ above dark shining purple blue, border 1½mm. to 3 at apex ; ♀ shining blue, border 3mm., all costa and apex black to v4, a small spot mid 3. Below grey brown to purple brown, markings prominent but much more regular and narrower ; unh discal band usually discontinuous at dorsum. Apex F produced and termen straight.

atrax, Hew. (32-38). The Dark Brokenband Oakblue. Shan States—S. Burma. NR.

19 (17-18-20). ♂ above shining violet blue, or silvery blue, overlaid violet : border F 1mm.—1½ at apex. ♀ pale blue, border 1½mm.—5 at apex, ½mm. on costa, leaving blue above the cell, the black apex angled at v4. Below rather pale ochreous or grey brown with slight pinkish wash. Very variable above and below.

* *ariana, Evans.* (35-42). The Pale Brokenband Oakblue. Dawnas—S. Burma. R.

20 (17-19). ♂ above purple, border ¾mm.; ♀ as last. Below ochreous brown to slightly purple brown. Wings much more rounded than in the rest of the group and unh tornal green scales much more sharply defined.

rafflesii, DeN. (37-40). Raffles' Oakblue. Mergui—S. Burma. R.

21a (16d). Unf discal band not much dislocated at v4, spot in 4 never pushed out and never more than a single costal spot (in 10 over the end cell spot).

21b (25a). Of large size, over 45mm. Unh discal band in 2-5 straight, confluent and directed to the tornal lobe ; tornal green scales prominent and usually diffuse ; discal spot in 6 with its outer edge oblique and well inside the inner edge of the spot in 5.

silhetensis Group.

21c (24). Below ochreous brown.

21d (23). Unf discal band dislocated at v4, lower part shifted in ; always a costal spot in 10. Unh discal band slightly dislocated at v4.

21 (22). Unf costal spot in 10 never so wide as the spot end cell ; upper part of discal band straight or uppermost spot shifted in. Termen F straight.

a. ♂ above violet blue, border F 2mm. Below greyish ochreous ; bands and spots large and prominent ; unh tornal green scales faint or absent.

* *silhetensis silhetensis, Hew.* (50-56). The Sylhet Oakblue. Sikkim—N. Burma. R.

β. ♂ above shining purple blue, border F ½mm. Below clear ochreous brown, spots usually small and sharply defined.

H. 49. Amblypodia—(*contd.*)

silhetensis arama, DeN. (50-56). Karens—S. Burma. R.

22 (21). Unf costal spot in 10 very large, as wide as the spot end cell ; upper part of discal band arched. ♂ above shining purple blue, border F ¾mm. ♀ border broad, and may be a spot end cell and a black patch beyond. Unh tornal green scales prominent.

* *adorea, DeN.* (46-50). The Singapore Oakblue. Dawnas—S. Burma. R.

23 (21d). Unf discal band not dislocated at all at v4, may be slightly sinuous there ; costal spot in 10 present or absent. Below variable, may be slightly purple washed. ♂ above shining purple blue, border 1½mm.—5 at apex ; ♀ paler, bluer, border 2½—7mm.

* *adatha regia, Evans.* (48-50). The large Mergui Oakblue. Mergui. R.

24 (21c). Below rosy purple to purple brown ; unf costal spot in 10 present or absent. ♂ above shining purple blue, border F 1mm. ♀ paler, border 3mm., a dark patch beyond end cell.

apha, DeN. (46-50). The Vinous Oakblue. Dawnas—S. Burma. VR.

25a (21b). Not larger than 45mm. Unh discal band in 2-5 more irregular and discal spot in 6 with its outer edge more or less joining inner edge of spot in 5.

Phaenops Group.

25b (29a-31a). Below dull ochreous hair brown. Rather large and wings produced. Unf discal band sinous, no spot in 10.

25 (26a). Below rather dark brown, markings very wide and prominently outlined white. Unh central row spot enlarged ; discal spot in 6 very large, overlaps spot in 5 and usually not up to the spot end cell ; tornal green scales diffused. ♂ above shining violet blue, border 1mm. to 2 at apex, veins black, especially on H.

arata, Tyt. (44). Tytler's Dull Oakblue. Manipur. VR.

26a (25). Below markings dull and narrow.

26 (27a). Unh discal spot in 6 midway between the spot end cell and the spot in 5 or nearer the former ; tornal green scales sharply defined, prominent. ♂ above very deep purple blue, border ½mm. ; ♀ paler and borders very broad.

agrata, DeN. (44). DeNiceville's Dull Oakblue. Manipur—Burma. R.

27a (26). Unh discal spot in 6 much nearer the discal spot in 5 ; spots in 7, 6 and 5 in echelon with their centres more or less in line. Below markings very obscure.

27 (28). Unh no tornal green scales. ♂ above bright violet blue, border 1½mm ; ♀ as next.

œnea, Hew. (46). Hewitson's Dull Oakblue. Sikkim—Assam. R.

28 (27). Unh with more or less prominent metallic green scales at tornus. ♂ above dark purple blue, border ½mm ; ♀ purple blue costal and terminal border F 4mm. and on H blue only about cell.

khamti, Doh. (46). Doherty's Dull Oakblue. Sikkim—N. Burma. NR.

29a (25b-31a). Below rather dark ochreous hair brown with prominent markings and tornal green scales H ; rarely a very faint purple wash. Unf usually a spot in 10, discal band variable, may be straight, sinuous or slightly broken at v4 ; unh discal spot in 6 overlapping spot end cell or intermediate between it and the spot in 5. ♀ purple with broad borders.

H. 49. Amblypodia—(*contd.*)

29 (30). ♂ above bright shining deep blue, border F 1mm. ♀ purple colour extending into the black apex, thereby forming a black patch end cell.

* *phœnops aroa, Hew.* (34-40). The Bright Oakblue. Karens—S. Burma. NR.

30 (29). ♂ above dark purple blue, border F 1mm. ♀ purple colour not extending into the black apex. Wings much more rounded.

pryeri, But. (38-42). The Roundwinged Bright Oakblue. Dawnas—S. Burma. R.

31a (25b-29a). Below with a more or less well developed rosy, pinkish to purple gloss. Unf a more or less prominent costal spot in 10.

31b (33a). Unh discal spot in 6 more or less overlapping the spot end cell and the centres of spots in 7 and 6 in line with spot end cell.

31 (32). Unh discal spot in 5 well separated from the spot end cell. Below variable, the rosy pink gloss variable in shade and intensity.

a. Unf discal band usually broad, curved, sinuous, upper portion oblique: unh tornal green scales prominent. ♂ above bright deep blue, border F 1½—2mm. ♀ shining blue with broad borders. Very variable.

* *alea alea, Hew.* (34-40). The Rosy Oakblue Karens—S. Burma. NR.

β. Unf discal band straight and narrow. Unh tornal green scales faint. ♂ above bright deep blue, border 1½mm. ♀ shining blue.

alea constanceæ, DeN. (40). Andamans. VR.

32 (31). Unh discal spot in 5 conjoined to spot end cell or only separated by a double white bar; discal band very irregular. Unf discal band continuous, straight or slightly curved. Below purple brown with a purple glaze; unh tornal green scales rather faint. ♂ above dark shining violet blue; ♀ paler purple blue, border broad and with more or less of a spot end cell.

a. Below uniform. Unh inner submarginal line prominently zigzag. ♂ border F 1mm.

agaba aurelia, Evans. (36-44). The Purple-glazed Oakblue. Manipur—N. Burma. R.

β. Below patchy, apex and costa F and H except termen, as well as all the markings with a whitish glaze. Unh inner submarginal line obscured. ♂ border F ¾mm.

* *agaba agaba, Hew.* Karens—S. Burma. NR.

33a (31b). Unh discal spot in 6 with its inner edge clear of the outer edge of the spot end cell. Unf discal band unbroken and on H discal band in 2-5 very compact. Unh tornal green scales usually faint and diffused.

33 (34-35). Below rather pale purple brown with a purple wash. Unf no spot in 10. Unh basal and central spots unusually small and bar end cell very narrow. ♂ above dark shining violet blue, border 1mm.; ♀ paler purple, a spot end cell F and on H the purple colour confined to the cell.

canaraica, M. (44-45). The Kanara Oakblue. S. India. R.

34 (33-35). Below pale grey brown, more or less washed pinkish. Unf with a costal spot in 10, discal band very straight. Unh discal band almost continuous from 2-7. ♂ above dusky purple, border F 2mm. to 4 at apex, H blue to just beyond end cell. ♀ border 3mm. to 6 at apex and on H blue colour absent or with traces at base.

* *hewitsoni, BB.* (34-40). The Indian Oakblue. S. India—Dun—Dawnas. C.

H.49. Amblypodia—(*contd.*)

35 (33-34). Below pale silky ochreous brown. Unf with costal spot in 10 discal band very straight and a prominent oblique spot in 1. Unh discal band almost continuous from 2-7. ♂ above dusky purple, ♀ blue ; border F 3mm. to 6 at apex, a spot end cell and a whitish streak beyond ; on H blue to just beyond cell. Wings produced.

* *alemon, DeN.* (35-44). The Silky Oakblue. Manipur—Dawnas. C.

36a (16c). Unh discal band never dislocated at v2. (except No. 56).

36b (50a-54a). Tailed and F termen never concave just below the apex.

Centaurus Group.

36c (44a). Unh discal spot in 6 overlapping spot end cell and the spot in 5, its outer edge concave.

36d (39a). Unf discal band continuous, not broken at v4 ; spot in 10 over end cell obscure or absent.

36 (37a). Unf an oblique discal spot in 1 ; unh tornal green scales faint or absent, no lobe or tornal black spots. Below dark ochreous brown, markings obscure ; unf markings in cell defined by vertical silver lines, discal band sinuous ; unh markings faint, discal spot in 5 close to spot end cell. ♂ above dark violet blue ; ♀ paler with broad borders. F apex produced and termen straight.

a. ♂ border F 1mm. ♂♀ paler basally.

centarurus pirama, M. (53-62). The Centaur Oakblue. Ceylon, S. India. NR.

β. ♂ border ¾mm. ♂♀ uniform above.

centaurus pirithous, M. Kumaon—Assam. NR.

γ. ♂ border ½mm. ♂♀ uniform above.

* *centaurus centaurus, F.* Burma. NR.

δ. ♂ border ½mm. Bases conspicuously paler, especially in ♀.

centaurus coruscans, WM. Andamans. NR.

37a (36). Unf no discal spot in 1 or only a faint one in continuation of the discal band. Wings rounded.

37 (38). Below purple brown. Unh discal spot in 5 well separated from the spot end cell, tornal green scales more or less prominent and with a small lobe. Below purple brown with a conspicuous glaze. Above ♂ dark shining blue, border F 1½mm. increasing to 3 at tornus and apex and on H ; ♀ paler, border 4mm. and a black spot end cell.

paralea, Evans. (40-45). The Glazed Oakblue. Manipur—Shan States. R.

38 (37). Below ochreous brown with prominent markings ; unf with a costal spot in 10 and discal band sinuous ; unh sharply defined tornal green scales and lobe, discal spot in 5 well separated from the spot end cell. Above ♂ shining purple blue, border F 1mm.

cooperi, Evans. (42-44). Cooper's Oakblue. Mergui. VR.

39a (36d). Unf discal band conspicuously broken at v4, lower part shifted in and upper part oblique. Unh lobe well developed and always with more or less diffuse tornal green scales.

39 (40a). Unf dark area under cell produced along 1 to the discal band ; no costal spot in 10. Unh discal band very sinuous, spot in 5 at right angles to the spot in 4. Below grey brown to dark ochreous brown, markings prominent. Above ♂ dark shining blue ; ♀ brighter and paler with broad borders and a spot end cell.

H. 49. Amblypodia—(*contd.*)

a. ♂ above border F 1mm.

amantes amantes, Hew. (45-57). The Large Oakblue. Ceylon, S. India—Dun—Sikkim. NR.

β. ♂ border upf 4mm.

* *amantes amatrix, DeN.* Manipur—Dawnas. NR.

40a (39). Unf dark area under cell quite separate from the discal band; usually prominent costal spot in 10. Unh discal spots square, moderately regular, in a stepped line.

40b (42a). ♂ above purple; ♀ uph no blue and on F the broad dark border continued a little along the dorsum.

40 (41). Unh the central cell spot joined to the central costal spot. Below rather pale brown, apex F whitish; H centre of disc and margin shining yellow. ♂ above dark purple, border F 2mm. and a spot end cell; ♀ rather pale purple.

**singla, DeN.* (44-48). The Yellowdisc Oakblue. Sikkim—Karens. NR.

41 (40). Unh central cell spot never joined to central costal spot. Below ochreous brown to brown with a silky gloss; F apex whitish; H prominently, but sparsely sprinkled white scales, margin and markings more or less shining yellow. ♂ above very dark purple, very nearly black, border F 1mm., 2 on H; ♀ as last.

**bazalus, Haw.* (44-48). The Powdered Oakblue. Sikkim—Karens. NR.

42a (40b). ♂ above green. ♀ with more or less blue colouring on H. Unh bar end cell well separated from the spot in 5.

42 (43). ♂ above bright metallic brassy green, border F under 3mm. Unh bar end cell narrow. ♀ purple blue with broad borders.

a. Wings rounded. ♂ upf border from 2mm at apex to 4 at tornus; H green to just beyond the cell. Below uniform rather pale brown with a silky gloss; H tornal green scales diffused. ♀ borders very broad and continued along dorsum.

**eumolphus eumolphus, Cr.* (44-50). The Green Oakblue. Sikkim—Karens. NR.

β. Apex F produced. ♂ upf border 1mm at apex to 3 at tornus, green area more extensive on H. Below as last, but apical area F and H broadly pale, whitish. ♀ border narrower, not continued along dorsum F.

eumolphus hellenore, Doh. Assam—Tavoy. NR.

γ Wings rounded. ♂ above as last. Below uniform ochreous brown, no silky gloss; H tornal green scales sharply defined, brilliant.

eumolphus maxwelli, Dist. Mergui. VR.

43 (42). ♂ above metallic peacock green, border F 6mm. at tornus to 9 at apex. ♀ bright shining blue, border narrower than in ♂ 4mm. and a black spot end cell. Below very dark ochreous brown, ♀ ferruginous brown, markings wider than usual, tornal green scales sharply defined, brilliant.

horsfieldii eurysthenes, Fruh. (40-46). The Peacock Oakblue. Dawnas—S. Burma. R.

44a (36c). Unh discal spot in 5 outwardly rounded, not overlapping both spot end cell and the spot in 5, usually central, just filling the gap. Unf no spot in 10. Lobed.

44b (46a). Unh more or less overlaid white scales.

44 (45). Below entirely overlaid white scales except for the markings on F and about costa H, which are dark chocolate; unf discal band slightly broken at v4; unh tornal green scales sharply defined. ♂ above dark shining purple border ½mm. ♀ entirely dark brown.

H. 49. Amblypodia—(*contd.*)

ormistoni, Riley. (46). Ormiston's Oakblue. Ceylon. VR.

45 (44). Below apex F and H inside the wavy submarginal line and below v8 overlaid white scales, remainder dark chocolate. Unf discal band completely broken at v4 and the discal spot in 3 joining spot end cell; markings prominently outlined white. Unh discal spot in 7 larger than the spot in 6, both prominently chocolate as also are the central and basal spots in 7, which are close together and conjoined to the chocolate area in 8; tornal green scales obscure. ♂ above purple, border F 2mm to 3 at apex and tornus. ♀ purple, paler, border 4mm, running along dorsum and very broad at apex; H only cell purple.

**bazaloides, Hew.* (44-47). The Tamil Oakblue. S. India, Assam—N. Burma. R.

46a (44b). Unh not overlaid white scales.

46b (49). Below ochreous hair brown; unh tornal green scales prominent, discal band continuous to dorsum.

46c (48). Unf discal band slightly broken at v4.

46 (47). Unf base 1 under cell entirely filled dark brown up to origin of v2. Below markings very large. ♂ apex F pointed; above very deep purple blue, border F ½mm and veins brownish. ♀ bright purple blue, border F 1-5mm at apex, black spot end cell.

corinda acestes, DeN. (50-55). The Ultramarine Oakblue. Mergui. VR.

47 (46). Unf no prominent dark basal area under cell. Below dark ochreous brown. ♂ above shining purple blue, border F 1½mm., veins outwardly narrowly black.

vihara, Fd. (52). Felder's Oakblue. Mergui. VR.

48 (46c). Unf discal band unbroken but bent at an angle of 140 degrees at v4. Below rather pale ochreous brown. ♂ ♀ alike rather pale blue, border H and at tornus F 2mm to 6 at apex.

woodii, Ollenbach. (40-50). Wood's Oakblue. Tavoy—S. Burma. R.

49 (46b). Below pale grey brown turning whitish at apex F and H. Unf spot base 3 joining spot end cell and the spot base 2; discal band broad, continuous, directed to tornus, spot in 3 slightly elongated inwards; dark broad submarginal spots in 2 and 3; all markings black, except upper part of discal band, which is whitish. Unh all markings pale, black edged, more markedly so near costa, discal spot in 3 shifted in, joining spot end cell; no tornal green scales. Above pale silvery blue, border F 4mm.; ♀ with black spot end cell.

alesia, Fd. (42-44). The Pallid Oakblue. Dawnas—S. Burma, Andamans. R.

50a (36b. 54a). F termen pointed and sharply concave below the point. Unh discal band discontinuous to dorsum, tornal green scales absent or faint. Tailed or tailless; small lobe.
Rama Group.

50b (53). Tailed.

50c (52). Below markings regular. Unf discal band continuous, slightly broken at v4, at most a single costal spot in 10. Unh discal band not broken at v2.

50 (54). Below pale silky ochreous brown, markings prominent on F, faint on H; unh discal spot in 6 between spots end cell and in 5, not overlapping either. Above ♂ ♀ alike, pale blue, border F 4mm. to 6 at apex, slightly continued along dorsum, a spot end cell and whitish beyond; H border 4mm. vs blackish. Termen F crenulate

H. 49 Amblypodia—(*contd.*)

**dodonaea, M.* (38-44). The Pale Himalayan Oakblue. Chitral—Kumaon. C.

51 (50). Below purple brown with a silky gloss. Unh discal spot in 6 large, overlapping spot end cell and spot in 5 and outwardly concave. Above ♂ dark violet blue; ♀ purple with broad borders and a spot end cell F.

a. ♂ above border 1½-2mm. and extending slightly along dorsum; on H 3mm. ♀ border 4-7mm. and on H blue to just beyond cell. Below markings dull and faint.

rama rama, Koll. (38-40). The Dark Himalyan Oakblue. Kashmir—Sikkim. C.

β. ♂ border F 1mm. and on H just under 1mm; ♀ purple more extensive. Below markings darker and better defined.

**rama ramosa, Evans.* (34-40). Manipur—Dawnas. NR.

52 (50c). Below ochreous with dark irregular markings. Unf 2 costal spots, discal band very irregular and broken. Unh markings rather obscure, discal band completely broken at v2. Wings very produced especially at tornus H. ♂ ♀ above shining purple, border F 4mm. to 7 at apex and a spot end cell; H only purple at base.

comica, DeN. (42). The Comic Oakblue. Manipur—Shan St. VR.

53 (50b). Tailless. Below ochreous brown, markings inconspicuous and as in No. 51; unf cell spots may be obsolete. Wings rounded ♂ above dark violet blue, border F 2mm.; H blue to just beyond cell. ♀ purple with broad borders, a spot end cell F and on H cell only purple.

**paramuta, DeN.* (30-35). The Hooked Oakblue. Sikkim—Karens. NR.

54a (36b-50a). Tailless and F not concave below apex. Unh discal band discontinuous to dorsum; unf no costal spot in 10.

Agelastus Group.

54b (59a). Below rough looking, ochreous brown to grey brown. Unf discal band straight, not sharply angled at v4, usually a spot base 3.

54 (55a). Unh central cell spot large, its iris touching the iris of the spot end cell. Below ochreous brown, all markings large and prominent, ringed pale yellow and with pale yellow patches at apex F and on H; unh inner submarginal line zigzag, small black lobe and faint tornal green scales. Above ♂ purple with broad borders F and H: ♀ rather pale blue, border F 3mm. to 5 at apex.

**alaconia oberthuri, Fd.* (38-40). The Patchy Oakblue. Karens—S. Burma. R.

55a (54). Unh central cell spot small, well separated from spot end cell. Unf often a broad dark area under cell; discal band variable, often very broad.

55 (56a). Unh with tornal green scales. Below ochreous brown. Below markings may be wide and confluent, pale edgings dull. ♂ above shining purple, border F 2mm to 5 at apex; ♀ brilliant shining blue, border as in ♂.

**agelastus, Hew.* (39-42). The Green-edged Tailless Oakblue. Shan States—S. Burma. NR.

56a (55). Unh no tornal green scales.

56 (57-58). ♂ above violet blue, ♀ pale blue, rather dusky, border F 3mm to 6 at apex. Below uniform ochreous brown, markings well defined: may be a purplish wash.

asopia, Hew. (42-46). The Plain Tailless Oakblue. Manipur—S. Burma. NR.

57 (56-58). ♂ shining purple, ♀ pale blue, border F and H 4mm., even. Below paler, greyish ochreous brown, darker at base H, markings prominent. Wings very rounded and smaller.

H- 49 Amblypodia—(*contd.*)

zeta, M. (30-36). The Andamans Tailless Oakblue. Andamans. R.

58 (57-56). ♂ above shining purple, ♀ pale purple, rather dusky; ♂ border 2mm., ♂ 4mm.; ♀ H blue colour confined to cell. Below over laid pinkish grey on costa and apex F and on all H, markings prominent.

œeta, DeN. (38). The Dawna Tailless Oakblue. Dawnas. R.

59a (54b). Below smooth looking; unf discal band bent at v4, no spot base 3.

59b (63a). Below uniform.

59 (60a). Unf spot mid cell very large, reaches mv. Below purple brown all markings very large and basal spots H crowded together; no tornal green scales. ♂ above light dull purple blue, border F 2mm. to 6 at apex.

belphœbe, Doh. (40). The Large-spotted Oakblue. Tavoy (Doh). VR.

60a (59). Unf spot mid cell does not reach mv; unf discal band prominently bent at v4.

60 (61a). Below dark ochreous hair brown, with narrow, dull, regular markings, tornal green scales sharply defined, brilliant. ♂ above dark shining purple blue, border F ¼mm., ♀ blue, border 4-6mm.

* *antimuta, Fd.* (30-36). The Small Tailless Oakblue. Karens—S. Burma. NR.

61a (60). Below glazed purple brown, markings prominent, but edging dull; unh no tornal green scales and discal spot in 6 more or less excavate outwardly. Tornus H angled and slightly lobed.

61 (62). ♂ above rich shining dark purple, no border. ♀ rather pale blue, border F 3mm. to 6 at apex, narrow on costa and no spot end cell or beyond.
* *arvina, Hew.* (38-42). The Purplebrown Tailless Oakblue. Dawnas—S. Burma. R.

62 (61). ♂ above rather pale shining blue, border F 1mm. to 4 at apex and a black patch beyond cell, joined to the costal border; ♀ border 3mm. to 7 at apex and the black area beyond cell coalesced to apex.

adala, DeN. (38). The Ladylike Tailless Oakblue. Dawnas—S. Burma. VR.

63a (59b). Below not uniform. Unh no tornal green scales or lobe.

63 (64). Unh centre of wing broad yellow, base, margin and all F washed purple over purple brown; unh markings obscure. ♂ border F 2mm. to 3 at apex; ♀ paler, border 3-6mm.

a. ♂ above dark shining violet blue.

* *perimuta perimuta, M.* (30-37). The Yellowdisc Tailless Oakblue. Sikkim—Tavoy. NR.

β. ♂ above bright shining metallic blue.

perimuta regia, Evans. (36-38). Mergui—S. Burma. NR.

64 (63). Unh centre of wing and apex whitish violet, rest rather pale purple brown, washed pale purple; unf discal band unusually broad and running to tornus; unh markings well defined. ♂ ♀ above shining metallic blue, purple in a side light, border 2mm. to 5 at apex; H only indications of blue in cell.

* *duessa, Doh.* (32-38). The Violetdisc Oakblue. Dawnas—S. Burma. R.

65a (16b). Unf with a costal spot base 11 between basal and central cell spots; also costal spots over central and end cell spots. Unh basal and central spots crowded together, irides touching, a prominent spot base 8, discal band completely dislocated at v2 and discontinuous to dorsum.

H. 49 Amblypodia—(*contd.*)

Ganesa Group.

65b (71). Unf discal band continued full width to v2 and often extending into 1, usually broken more or less at v4 ; inner cell spots reaching mv.

65 (66a). Tailless. ♂ ♀ above rather pale blue, border F 3mm. to 6 at apex, a prominent spot end cell on either side of which there is a whitish patch. Unh no tornal green scales. Apex F acute and inner margin much produced ; H costa concave, apex pointed, termen straight to v6.

a. Below creamy white, markings F prominently dark brown, but somewhat overlaid whitish ; nearly invisible on H.

* *ganesa ganesa, M.* (32-37). The Tailless Bushblue. Chitral—Kumaon. C.

β. Below bases rather pale purple brown ; markings F more prominent, not overlaid whitish ; H markings prominent.

ganesa watsoni, Evans. Assam—Shan States. R.

66a (65). Tailed. Below rather pale to dark chocolate brown with white patches ; spots large, prominent, white edged.

66b (69a). Unf discal band more or less broken, but never so that the inner edge of the spot in 4 is in line with the outer edge of the spot in 3.

66c (68). Unf discal spots not so regular as in 68.

66 (67). Unh no prominent white patch mid costa and uph blue colour confined to cell. Unh no tornal green scales. H costa straight and apex sharp.

a. ♂ above dull violet blue, border 3mm. to 5 at apex, prominent spot end cell and a whitish patch beyond. ♀ duller, white area F extending to inside cell.

paraganesa paraganesa, DeN. (30-34). The Dusky Bushblue. Kumaon—Bhutan. NR.

β. ♂ above entirely dark brown except for a few scattered blue scales at base F. ♀ blue scaling as extensive as in ♂ of last.

paraganesa zephyretta, Doh. Assam—Shan States. R.

67 (66). Unh prominent white patch mid costa, as prominent or more so than the apical patches F and H.

a. Very much as *β*, but ♂ above purple instead of blue.

ammonides ariel, Doh. (29-31). The Malayan Bushblue. Assam—N. Burma. VR.

β. ♂ above pale metallic blue, border 2mm. F and H, to 5 at apex F. ♀ paler and duller. Below dark purple brown rendering white patches very prominent. Wings very rounded. No tornal green scales.

ammonides ammonides, Doh. (29-31). Dawnas—S. Burma. R.

68 (66c). Unf inner edges of spots in 5 and 6 in line and regular, also inner edge spot in 4 against middle of spot in 3. ♂ above rather dull violet blue, border F 1-2½ mm. to 3-4 at apex, extending along the costa. ♀ rather pale blue, border 2½-5mm., a white patch on either side of the black spot end cell ; 1mm. on H and veins widely blackened just before the border. Below rather dark purple brown, white patches more or less prominent and may obscure the markings : unh with tornal green scales.

birmana, M **(30-39). The Burmese Bushblue. Manipur—Shan States. NR.**

69a (66b). Unf discal band completely dislocated at v4, so that the inner edge of the spot in 4 is in line with the outer edge of the spot in 3. ♀ as No. 75 but paler and the white patch on F is larger and extends well into the cell.

H. 49. Amblypodia.—(*contd.*)

♂ above pale violet blue. Unh tornal green scales more or less prominent. Below much as No. 68. F dorsum produced. Uph cilia nearly uniform.

69 (70). ♂ border less than 1mm. on F and H. Below uniform pale brown all over, white patches obscure.

aberrans, DeN. (32-38). The Pale Bushblue. Manipur—Shan States. R.

70 (69). ♂ above border 1mm. to 2 at apex, F, continued slightly inwards along the veins. Below bases pale brown, rest whitish. Uph cilia chequered white at end of each vein.

* *ellisi, Evans* (37-42). Ellis' Bush-blue. Manipur—Shan States. R.

71 (65b). Unf discal band continued full width to v3 only, a small spot against the outer edge in 2 ; band irregular, semi-broken at v5, inner spots in cell small, not extending to mv. Below dark purple brown, washed purple, outer half F and margin H pale brown. H apex very dark and usually a prominent quadrate white patch mid costa ; discal band attenuate towards dorsum ; with tornal green scales. Very short tail at v3 and usual tail at v2. Lobed.

α. ♂ above shining violet blue, border 2mm. to 5 at apex, 2 on H. Wings very rounded. Unf discal band unbroken.

abseus mackwoodi, Ril. (32-35). The Aberrant Bushblue. Ceylon. R.

β. ♂ above dull purple, border 4mm. to 7 at apex, 5 on H. ♀ pale blue, border 3-6mm. and a spot end cell.

**abseus indicus, Riley.* Sikkim—Tavoy. NR.

γ. ♂ above brilliant deep purple blue, border 2mm. to 4 at apex, 2 on H. ♀ pale metallic violet blue, border as ♂.

abseus abseus, M. Tavoy—S. Burma. R.

72a (1a). Unf cell spots abnormal.

72b (80). Unf very dark brown, cell usually containing a pale spot near end and sometimes a second spot nearer base, no dark spots : discal band continuous, bent at v4, flanked by a pale area on either side, no costal spots ; pale areas vary from purple brown to violet or whitish. Unh with a dark basal area or basal spots absorbed into a dark sub-basal band.

Apidanus Group.

72c (75a). Unh discal spots in 7 and 6 from a dark bar coalesced to the dark spot end cell, all inner edges in line. H lobe prominent and with tornal green scales.

72d (74). H with a well defined tail at v2. Below markings large, well defined on a violet brown ground. Apex F and tornus H produced.

72 (73). Unh a large basally bifid black spot mid costa not reaching the black area, which extends from base to mid cell and from costa to dorsum. ♂ above deep rich purple blue, no border. ♀ bright purple, borders broad and continued along dorsum F.

**diardi, Hew.* (40-54). The Bifid Plushblue. Sikkim—Dawnas. NR.

73 (72). Unh spot mid costa continued as a broad band across cell to base dorsum, above it there is a pale area from the base along the costa. ♂ ♀ above as last.

fulgida Hew. (36-46). The Shining Plushblue. Sikkim—Shan States. NR.

74 (72d). Tailless. Wings produced in ♂, rounded in ♀. ♂ above most brilliant dark purple blue, no border. ♀ pale blue shading to purple, borders broad. Unf lower outer area pale brown, discal band abbreviated

H.49. Amblypodia.—(*contd.*)

Unh almost entirely dark brown with a whitish violet fascia from mid termen to mid dorsum, a small apical patch and another mid costa, which sometimes extends to the dorsum; markings as last, but nearly invisible, basal third all black.

**anniella artegal, Doh.* (34-44). The Brilliant Plushblue. Shan States—S. Burma. R.

75a (72c). Unh discal spots in 7 and 6 much more macular and irregular, inner edge of spot in 6 in line with outer edge of spot end cell. Wings rounded.

75b (78a). Tailed and lobed.

75 (76a). Unh basal area very broadly dark brown, unmarked; central area broadly pale brown, followed by a dark oblique submarginal area and about tornus pale again; metallic green scales at tornus well developed.

a. ♂ above purple blue, border F 1mm. to 2 at apex, 1½ on H. ♀ pale blue, borders broad.

**apidanus ahamus, Doh.* (34-40). The Plain Plushblue. Cachar—Karens. R.

β. ♂ above darker, border less than 1mm. ♀ as last.

apidanus apidanus, Cr. Dawnas—S. Burma. R.

76a (75). Unh basal area variegated; extreme base at costa pale, discal markings shining purple brown on a dark area, central and tornal areas pale.

76 (77). Unh no metallic tornal green scales, lobe small; sub-basal dark band extends to mid cell. ♂ above bright purple blue, border 2 mm to 3 at apex, 3 on H. ♀ rather pale purple, borders broader.

adriana, D N. (38-44). The Variegated Plushblue. Sikkim—Shan States. NR.

77 (76). Unh with tornal green scales, lobe prominent; sub-basal dark band to dorsum. Above as last.

asoka, DeN. (40-44). The Spangled Plushblue. Sikkim—Shan States. NR.

78a (75b). No lobe or tail. F slightly concave below the sharply pointed apex, ♂ above shining deep rich ultramarine blue. ♀ purple with very broad borders.

78 (79). Unh broad basal dark area crossed near base by a pale band from base to costa, pale area beyond the dark basal area narrow, tornal green scales prominent. Unf obscure short reddish streak along costa from base. ♂ above border a thread, 1mm. at apex; H toothed at each vein especially at v2, margin F rather crenulate.

chinensis, Fd. (43-46). The Chinese Plushblue. Sikkim—Assam. NR.

79 (78). Unh no pale band on the dark basal area; pale discal area much broader.

a. Unh no tornal green scales, all markings obscure. Unf pale cell spots prominent. Margins not so crenulate as last. ♂ above border from 1mm. to 2 at apex. Blue colour deeper than in last.

areste areste, Hew. (40-46). The Tailless Plushblue. Sikkim-Assam. R

β. Unh with tornal green scales; all markings more prominent. Margins more crenulate. Unf pale cell spots obscure. ♂ border narrower.

areste arestina, Evans. (41-46). N. Shan States. R.

H. 49 Amblypodia—(*contd.*)

80 (72b). Below pale ochreous brown devoid of markings except for a narrow obscure dark brown postdiscal and marginal fascia and some very obscure basal spots H. ♂ above bright shining violet blue, becoming purple outwardly. ♀ paler and bluer. Apex F pointed; H rounded, no tail or lobe or tornal green scales unh.

"α." ♂ above border under 1mm. ♀ border 2-6 F and 1 on H.

**fulla ignara, Riley.* (36-38). The Spotless Oakblue. Sikkim-Burma. R.

β. ♂ above border 1-2½ at apex; ♀ paler than last.

fulla andamanica, WM. (38-39). Andamans. R.

The following are new names :—

Nacaduba dubiosa indica and *fulva* (H. 30·15); *Jamides celeno blairana* and *nicevillei* (H. 31·6); *lugine purpura* (H. 31·10). *Thecla bieti irma.* (H42·2); *Thaduka multicaudata kanara* (H. 47); *Amblypodia karennia* (H. 49.7); *anthelus anthea* (H. 49·2); *epimuta elsiea* (H.49·11); *ariana* (H. 49·19); *agaba aurelia* (H. 49·32); *parelea* (H. 49·37); *cooperi* (H. 49·38); *perimuta regia* (H. 49·63); *areste arestina* (H. 49·79); *Heodes phlaeas indicus* (H. 35·2).

(*To be continued.*)

NOTES AND DESCRIPTIONS OF INDIAN FISHES.

By

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Part III.

(*Continued from page* 321 *of this volume.*)

The specimens sent from the Madras Fisheries Department in August 1922 embrace nineteen species, two of which appear to be new. A set of the duplicates have since been returned to the Madras Fisheries Department for their use as records. According to the labels given, the localities are Tuticorin and Madras. It is with pleasure that I acknowledge my indebtedness to Mr. James Hornell, F.L.S., F.R.A.I., late Director of Fisheries, Madras, for the opportunity to study this interesting collection.

EXOCŒTIDÆ.

Parexocoetus mento (Valenciennes).

Head 4; depth 4; D.i, 10, i; A.i, 10,i; P. i, 11; V.i, 5; scales 39 from gill-opening above to caudal base and 2 more on latter; 5 scales above lateral line, 2 below; 25 predorsal scales; snout $3\frac{2}{5}$ in head measured from upper jaw tip; eye 3; maxillary $3\frac{1}{2}$; interorbital 3.

Body elongately fusiform, deepest about ventral origin, well compressed. Caudal peduncle compressed, least depth $\frac{2}{3}$ its length on $3\frac{3}{5}$ in total head length. Head width 2 in its length. Snout conic, rather wide, length $\frac{3}{4}$ its width. *Eye*—large, slightly impinging on upper profile, hind pupil edge midway in head length; diameter greater than snout, $1\frac{1}{8}$ in interorbital. Mouth small, lower jaw well protruded. Maxillary short, reaches opposite middle of nostril, largely concealed; expansion $2\frac{3}{4}$ in eye. Narrow band of fine teeth in jaws, on vomer and palatines, and patch on tongue. Nasal aperture small, triangular, close before eye. Interorbital level. *Gill-rakers*—7 + 18, lanceolate, $1\frac{1}{4}$ in gill-filaments or $2\frac{3}{4}$ in eye. *Scales*—with 4 to 6 imperfect basal radiating striae, edge lobate; circuli moderate, complete. Lateral line not extending far as end of anal base, tubes simple, slender. *Fins*—Third dorsal ray reaches caudal base, equals total head length; second anal ray $2\frac{1}{4}$ in head; upper caudal lobe $\frac{2}{3}$? of lower which $3\frac{2}{5}$ in combined head and trunk; pectoral reaches about opposite base of fifth dorsal ray, 2 in combined head and trunk; second and remaining pectoral rays all branched; ventral inserted midway between mandible tip and caudal base, fin reaching $\frac{9}{10}$ to anal or $1\frac{1}{3}$ in head.

Colour—Back olivaceous neutral tint, sides and lower surface whitish. Side of head, including lower sides of preorbital whitish. Edges of jaws brown. Dorsal neutral-dusky, blackish terminally. Caudal with each lobe dusky medianly, edges whitish. Anal whitish, middle of fin dusky. Pectoral neutral-dusky above, lower half whitish. Ventral white. One example, 115 mm. Madras.

Cypselurus unicolor (Valenciennes).

Head 4; depth $5\frac{1}{5}$; D.i, 10, i; A. i, 11, i; P. i, 15; V. i, 5; scales 49 from gill-opening above to caudal base and 4 more on latter; 6 scales above lateral line, 3 below to anal origin; 35 predorsal scales; snout $3\frac{1}{2}$ in head measured from upper jaw tip; eye $3\frac{1}{4}$; maxillary 4; interorbital $2\frac{2}{5}$.

Body elongately fusiform, deepest at ventral origin, but slightly compressed. Caudal peduncle compressed, least depth $1\frac{2}{3}$ its length or $3\frac{1}{2}$ in total head length. Head width $1\frac{2}{3}$ in its length. Snout broad, obtuse, length $\frac{2}{3}$ its width. *Eye*—large, slightly impinging on upper profile, hind pupil edge midway in head length diameter greater than snout, $1\frac{1}{3}$ in interorbital. Mouth small, lower jaw slightly protruded. Maxillary short, reaches opposite middle of nostril; expansion 4 in eye. Teeth fine, obsolete, short narrow band of very minute ones anteriorly; apparently none on palate or tongue. Nasal aperture small, triangular, close before eye. Interorbital broadly and slightly concave. *Gill-rakers*—7 + 24 lanceolate, $1\frac{1}{10}$ in gill-filaments or 2 in eye. *Scales*—adherent, narrowly, imbricated; basal radiating striae 3, edge lobate; circuli fine, concentric. Lateral line not extending beyond depressed dorsal, not reaching caudal base; preventral tubes finely venulose. *Fins*—First branched dorsal ray $3\frac{2}{5}$ in total head length; first branched anal ray $4\frac{2}{3}$, fin origin opposite that of dorsal; caudal widely forked, upper lobe $1\frac{1}{3}$ of lower, which $3\frac{1}{2}$ in combined head and trunk; pectoral reaches scale beyond base of last dorsal ray, second and following rays branched; ventral origin slightly nearer caudal base than hind eye edge, reaches middle of depressed anal, $3\frac{4}{5}$ in combined head and trunk.

Colour—Back neutral-olivaceous, sides and under surface whitish. Gray dots sprinkled all along side. Lower side of head, including preorbital, whitish. Dorsal and caudal dull gray-brown. Pectoral with membrane dusky-neutral, above and below pale to whitish. Anal white. Ventral pale, front edge whitish. One example, 197 mm. Madras.

Agrees in many ways with the figure by Jordan and Seale of their *Cypsilurus unicolor* except that is shown as more slender and with little longer ventral. The flying-fishes of this group (*Exonautes*) are often with some form of external parasite. The above example has a long dark *Penella*, a lernean copepod, protruding from along the anal base.

SCORPÆNIDÆ.

Apistus carinatus (Schneider).

Head $2\frac{1}{2}$ to $2\frac{3}{5}$; depth $3\frac{1}{4}$ to $3\frac{1}{3}$; D. xiv, I. 8, i; A. iii, 7, i; P. 12 + i; scales 43 to 48 in lateral line to caudal base and 3 more on latter; 7 scales above lateral line and 14 or 15 below to anal origin; 4 predorsal scales; snout 3 to 4 in head measured from upper jaw tip; eye $4\frac{1}{10}$ to $4\frac{1}{5}$; maxillary 2 to $2\frac{1}{8}$; interorbital $10\frac{1}{2}$ to $11\frac{1}{2}$.

Body elongately ovoid, compressed, deepest at ventral origin. Caudal peduncle well compressed, length $\frac{4}{5}$ its least depth which $3\frac{7}{8}$ to 4 in total head length. Head width half its length. Snout conic, length $\frac{4}{5}$ its width. *Eys*—impinging on upper profile, hind edge midway in total head length; diameter 1 to $1\frac{1}{8}$ in snout. Mouth large, mandible protruded. Maxillary reaches opposite hind pupil edge; expansion $1\frac{3}{4}$ to 2 in eye. Bands of minute, villiform teeth in jaws, on vomer and palatines. Symphyseal barbel $3\frac{1}{10}$ to $3\frac{1}{6}$ in total head length; lateral mandibular $3\frac{1}{2}$ to $4\frac{1}{10}$. Nostrils near together on side of snout; front one at first $\frac{2}{5}$, hind one lower and at last $\frac{2}{5}$. Interorbital slightly concave. Antero-supraorbital slightly raised, with 5 or 6 strong keels on front face. Strong median spine from preopercle at end of suborbital stay and 2 broader, shorter points below. Preorbital with 2 short points on lower edge forward and strong spine behind parallel with upper maxillary edge $\frac{7}{8}$ of eye. Opercle with 2 spines and like most of surface of cheek with broken striae or short keels. Low keel ending in short spines behind, above opercle, followed by suprascapular spine. Parietal keel double each side and also postocular. *Gill-rakers*—ii, 4 + 11, ii, lanceolate, $1\frac{1}{4}$ in eye, twice gill-filaments. *Scales*—with 8 to 12 broad radiating striæ; 5 apical pointed lobes, each with keeled midrib, edges of lobes minutely and sparsely dentate; circuli fine. Small patch of scales on cheek behind maxillary, head otherwise naked. *Fins*—Tenth dorsal spine $1\frac{7}{8}$ to $2\frac{1}{10}$ in total head length; first soft dorsal ray $1\frac{1}{2}$ to $1\frac{2}{3}$; third anal spine $2\frac{1}{2}$ to $2\frac{3}{4}$; second anal ray $1\frac{3}{4}$ to 2; caudal rounded behind, $1\frac{1}{8}$ to $1\frac{1}{6}$; ventral $1\frac{2}{5}$ to $1\frac{1}{2}$. Pectoral reaches far as base of last dorsal ray or caudal base, $1\frac{3}{5}$ to $1\frac{2}{3}$ in combined head and trunk.

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[1] Bull. Bur. Fisher, fr. S., 25, 1905 (1906), p. 209, fig. 12.

Colour—Pale brownish, whitish below. Dorsals pale, with black blotch larger than eye on posterior spines marginally. Front dorsal spines with dusky blotches terminally. Soft dorsal and caudal pale, with 2 dusky cross-bands. Anal grayish, with deeper blotches. Pectoral blackish, pale basally. Ventral whitish, dusky on inner rays terminally. Two examples, 82 to 90 mm. Madras.

Choridactylus multibarbis Richardson.

Head $3\frac{1}{5}$; depth $2\frac{2}{3}$; D. xiii, 9; A. ii, 8; P. i, 6, ii+ii; snout $2\frac{1}{3}$ in head; eye 4; maxillary $2\frac{3}{4}$; mouth width 4; interorbital 3.

Body well compressed, back elevated close behind head where greatest body depth, sloping down gradually behind. Caudal peduncle well compressed, least depth $3\frac{4}{5}$ in head. Head width $1\frac{1}{8}$ in its length. Snout broad, depressed, very steeply abrupt, about wide as long. *Eye*—elevated, greatly impinging on upper profile, hind edge midway in head length; fringed flap above long as pupil; diameter 2 in snout, $1\frac{4}{5}$ in interorbital. Mouth moderate, wide, mandible slightly shorter than upper jaw. Maxillary little inclined, reaches opposite eye center; expansion 2 in eye. Two fleshy mandibular barbels each side, front one longer, equals eye. Narrow band of villiform teeth in each jaw; palate edentulous. Nostrils in 2 short tubes, separated, near middle of snout, anterior slightly longer. Interorbital deeply concave. Supraorbital with broad antero and postero-marginal spines. Postocular spines 2, followed by larger suprascapular. Strong preorbital spine nearly long as eye, with 2 small shorter ones in front basally. Preopercle with strong spine, long as eye. *Gill-rakers*—3+8, short knobs, barely $\frac{1}{4}$ of gill-filaments, which $1\frac{2}{5}$ in eye. Head with numerous small variable fleshy excrescences; minute short filaments on dorsals and caudal, outer face of pectoral and base of ventral. Row of 14 fleshy points along lateral line. *Fins*—Third dorsal spine $1\frac{2}{3}$ in head; fourth dorsal ray $1\frac{2}{5}$; fifth anal ray $1\frac{4}{5}$; caudal rounded behind, $1\frac{1}{5}$; ventral 1. Pectoral $2\frac{4}{5}$ in combined head and trunk.

Colour—Pale purplish-brown generally. White blotch from behind third dorsal spine down opposite pectoral. Another at front of soft dorsal and down on trunk above anal, followed by 3 below, of which last largest. Caudal dusky basally and terminally, medianly white. Pectoral largely dusky marginally, pale medianly. Ventral and anal neutral black, margin of latter narrowly pale. Under surface of head, breast and abdomen whitish. Sides of abdomen finely spotted whitish. One example, 78 mm. Madras.

Minous monodactylus (Schneider).

Head $2\frac{1}{3}$ to $2\frac{2}{5}$; depth $2\frac{2}{3}$; D. ix or X, ii; A. ii, 9; snout $2\frac{2}{5}$ to $2\frac{2}{3}$ in head measured from upper jaw tip; eye $4\frac{1}{5}$ to $4\frac{4}{5}$; maxillary $2\frac{1}{10}$ to $2\frac{1}{4}$; interorbital $4\frac{1}{5}$ to $4\frac{1}{2}$.

Body elongately ovoid, well compressed, deepest at pectoral base. Caudal peduncle well compressed, least depth $4\frac{1}{5}$ to $4\frac{1}{4}$ in total head length. Head width $1\frac{1}{6}$ to $1\frac{1}{4}$ in its length. Snout obtuse, broad, length $\frac{3}{4}$ to $\frac{4}{5}$ its width. *Eye*—midway in head length, $1\frac{3}{4}$ to $1\frac{4}{5}$ in snout, equals interorbital. Mouth broad, mandible projecting. Maxillary reaches eye; expansion $10\frac{2}{5}$ in eye. Teeth in villiform bands in jaws and patch each side of vomer, none on palatines or tongue. Front nostril in short tube at first $\frac{2}{5}$ in snout; hind nostril smaller, about last fourth in snout. Interorbital deeply concave. Supraorbital ridge serrate, with broad serrated spine behind. Pair of large rugose parietal spines each side, large suprascapular further back, which preceded by row of 3 large rugose postoculars. Preorbital with long spines nearly equal to eye; small short one in front basally. Preopercle with spine equal to eye and 4 strong broad ones around edge of flange. *Gill-rakers*—5+12, larger clavate, $\frac{1}{3}$ of gill-filaments, which $1\frac{3}{4}$ in eye. Skin smooth; row of short supraorbital filaments, few fleshy papillæ on maxillary expansion; preopercle flange with few flaps and few along mandible. *Fins*—First dorsal spine $2\frac{3}{5}$ to $2\frac{3}{4}$ in head ; first dorsal ray $2\frac{1}{3}$ to $2\frac{3}{4}$: third anal ray $3\frac{1}{8}$ to $3\frac{2}{3}$; caudal rounded behind, $1\frac{1}{4}$ to $1\frac{2}{5}$; pectoral $1\frac{1}{4}$: to $1\frac{1}{8}$, filaments $1\frac{3}{5}$ to $1\frac{4}{5}$; ventral $1\frac{3}{5}$ to $1\frac{4}{5}$.

Colour—Back purplish-gray, with pale line above lateral line longitudinally and another close below similar. Lower surface whitish. Dorsals dusky marginally, with blackish marginal blotch at front of soft fin. Longitudinal whitish line on spinous dorsal medianly, also on soft dorsal. Anal neutral-black. Caudal whitish, with 3 transverse dusky cross-bands, median closer to outer, though fin edge narrowly whitish. Pectoral dusky-brown terminally, lower ray whitish. Ventral dusky-brown terminally, basally whitish. Five from Tuticorin, 80 to 94 mm.

Cocotropus echinatus (Cantor).

Head $2\frac{7}{8}$ to 3 ; depth $2\frac{4}{5}$ to $2\frac{7}{8}$; D. xiv, 10 or 11 ; A. ii, 8 ; snout 3 to $3\frac{1}{8}$ in head measured from upper jaw tip ; eye $3\frac{2}{3}$ to $3\frac{4}{5}$; maxillary $2\frac{4}{5}$ to $3\frac{1}{8}$; interorbital 4 to $4\frac{1}{8}$.

Body compressed, elongate, deepest at pectoral base and tapering down behind. Least depth of caudal peduncle $2\frac{4}{5}$ to 3 in total head length. Head width $1\frac{1}{4}$ to $1\frac{1}{3}$ in head. Snout obtuse, slightly broader than long. *Eye*—elevated, hind pupil edge midway in head length; diameter $1\frac{1}{8}$ to $1\frac{1}{6}$ in snout. Mouth low, mandible protruding. Maxillary reaches opposite eye ; expansion 2 in eye. Minute villiform teeth in bands in jaws, patch each side of vomer, none on palatines or tongue. Front nostril larger, in short tube at last $\frac{2}{5}$ in snout ; hind nostril smaller, similar, close before upper front eye edge. Interorbital convex, with 2 median parallel ridges from occiput to snout tip. Preorbital with strong bifid spine. Preopercle with 4 strong spines, upper largest. Opercle with 3 spines. *Gill-rakers*—5 low short knobs on lower branch of first arch, greatly shorter than gill-filaments, which $1\frac{1}{2}$ in eye. Lateral line of 11 long slender tubes to caudal base ; 1 more on latter. Trunk with minute scattered papillæ, most abundant and crowded on lower surface. *Fins*—First dorsal spine $1\frac{2}{3}$ to $1\frac{3}{4}$ in head ; first dorsal ray $2\frac{1}{4}$ to $2\frac{3}{4}$; first anal ray $3\frac{1}{4}$ to $3\frac{1}{3}$; caudal rounded behind, $1\frac{1}{4}$ to $1\frac{2}{5}$; pectoral $1\frac{1}{4}$ to $1\frac{1}{3}$; ventral $1\frac{3}{4}$ to $1\frac{4}{5}$.

Colour—Back purplish-brown generally, becoming white below. Fins all brownish, obscurely spotted or mottled with darker. Three examples, 38 to 51 mm. Madras.

Day describes fine brown radiating lines from the eye which are not clearly evident in my examples.

GOBIIDÆ.

Butis caperatus (Cantor).

Head $2\frac{2}{3}$ to $2\frac{7}{8}$; depth $3\frac{2}{3}$ to 4 ; D. vi—i, 8 or 9 ; A. i, 8 ; scales 22 to 25 from gill-opening above to caudal base medianly and 3 or 4 more on latter ; 9 scales transversely between soft dorsal and anal origins ; 12 or 13 predoral, scales ; snout $3\frac{2}{5}$ to 4 in head measured from upper jaw tip ; eye $3\frac{1}{4}$ to $4\frac{1}{10}$; maxillary $2\frac{1}{4}$ to $2\frac{1}{2}$; interorbital $5\frac{1}{8}$ to $5\frac{3}{4}$.

Body compressed, elongate, deepest at pectoral base. Caudal peduncle well compressed, least depth $2\frac{1}{6}$ to $2\frac{1}{5}$ in its length or $3\frac{1}{8}$ to $3\frac{1}{3}$ in total head length. Head width $1\frac{3}{4}$ to 2 in its length. Snout convex, length $\frac{3}{4}$ its width. *Eye*—large, slightly impinging on upper profile, hind edge midway in head length, long as mouth. Mouth large, lower jaw protruding. Maxillary reaches opposite middle of eye ; width $\frac{1}{4}$ to $\frac{1}{3}$ of eye. Teeth in outer row large, uniform ; inner band villiform in both jaws ; palate and tongue edentulous, latter truncate in front. Front nostril in short tube at last third in snout ; hind nostril simple pore close before eye. Interorbital deeply concave. Supraorbital, frontal and upper preorbital edges with rather firm short points. *Gill-rakers*—5+4 slender, lanceolate, little longer than gill-filaments on $1\frac{2}{3}$ in eye. *Scales*—with 13 to 21 basal parallel striæ; row of 15 to 21 + 18 to 21 apical denticles; circuli moderate. Predorsal scales only encroach on hind portion of interorbital. Cheek scaly above, 8 rows across, lower half naked. *Fins*—Dorsal spines flexible, third $2\frac{1}{8}$ to $2\frac{3}{4}$ in head; first ray $1\frac{2}{3}$ to $1\frac{4}{5}$; eighth ray 2; seventh anal ray $1\frac{9}{01}$ to $2\frac{1}{8}$; caudal ends in narrow point behind, $1\frac{1}{10}$; pectoral $1\frac{1}{8}$ to $1\frac{1}{4}$; ventral $1\frac{1}{3}$ to $1\frac{2}{3}$. Anal papilla large.

Colour—Brown generally. Each row of scales longitudinally with pale median line. Trunk with 8 transverse darker brown cross-bands. Dorsals neutral-dusky, soft dorsal with 2 rows of pale spots basally. Anal dusky. Caudal pale, dusky basally. Pectoral pale with black round spot at bases of lower rays. Ventral dusky-black. Side of head with 4 transverse or vertical deep brown bands. One from Tuticorin 37mm., and 7 from Madras 35 to 55 mm.

Butis butis (Buchanan-Hamilton).

Head $2\frac{7}{8}$; depth $5\frac{1}{2}$; D. vi—i, 9; A. i, 8; scales 21 from gill-opening above to middle of caudal base and 2 more on latter; 7 scales transversely at soft dorsal and anal origin; 17 predorsal scales; snout $3\frac{2}{5}$ in head measured from upper jaw tip; eye $4\frac{1}{10}$; maxillary 2; interorbital 2 in eye.

Body elongate, fusiform, midway in spinous dorsal length. Caudal peduncle compressed, least depth half its length or 4 in total head length. Head width half its length. Snout conic, length $\frac{3}{4}$ its width. *Eye*—high, superior, hind edge midway in head length. Mouth large, mandible well protruded. Maxillary reaches opposite hind pupil edge, narrow. Teeth in 2 rows in each jaw, conic some uneven or others larger; palate and tongue toothless, latter emarginate in front. Nostril close before eye. Interorbital narrow, level. *Gill-rakers*—2+5, short dimentary points, longest barely $\frac{1}{4}$ of gill-filaments, which about 2 in eye. *Scales*—with 8 to 11 radiating basal striae; apical denticles in row of 14 + 16 to 19; circuli fine. Scales become smaller on predorsal anteriorly, sides and front of head. *Fins*—Third dorsal spine 2 in total head length; second dorsal ray $1\frac{3}{4}$; seventh anal ray $2\frac{1}{2}$; caudal rounded, $1\frac{1}{4}$; pectoral $1\frac{2}{5}$; ventral $1\frac{1}{2}$.

Colour—Brownish, scarcely paler below. Spinous dorsal blackish. Caudal with blackish basal blotch, median rays dusky to ends. Other fins pale with dark blotch at base of each ventral. Pectoral base with median pale spot, dark spot above and below. One from Tuticorin 40 mm.

Boleophthalmus boddaerti (Pallas).

Head $3\frac{1}{3}$; depth $5\frac{1}{8}$; D. v—25, i, A. i, 24; scales 60 from gill-opening above to caudal base medianly and 5 more on latter; 18 scales transversely from soft dorsal origin to that of anal; 26 predorsal scales to eye; snout $3\frac{2}{5}$ in head measured from upper jaw tip; eye 7; maxillary $2\frac{1}{4}$; mouth width $2\frac{1}{3}$.

Body long, compressed, deepest at soft dorsal origin. Caudal peduncle compressed, least depth 3 in total head length. Head width 3 in its length. Snout broad, profile steeply oblique, length $\frac{4}{5}$ its width opposite end of maxillaries. *Eye*—elevated half diameter above upper profile, center at first third of head diameter 2 in snout. Mouth large, little inclined, lower jaw slightly included Maxillary reaches opposite hind eye edge, width $\frac{2}{3}$ of eye. Upper lip with broad cutaneous flap over front side of each maxillary. Teeth in jaws uniserial; upper with 6 flattened partially enlarged incisors in front, others conic; lower with lateral teeth compressed, bifid, small and small pair of wide-set canines anteriorly well inside; no teeth on palate or on thick rounded fleshy tongue Interorbital narrow, with deep concave median depression. *Gill-rakers*—6 + 7, short flexible points, $\frac{1}{3}$ of gill-filaments, which $1\frac{3}{4}$ in snout. *Scales*—small, thickly cover most of head, pectoral and caudal base; 20 or 21 waved radiating basal striae; 3 to 6 short apical radiating striae; circuli fine.

Fins—Dorsal spines filamentous terminally, median long as head ; twenty-second ray 2 ; twenty-third anal ray $4\frac{2}{5}$; caudal ends in median point behind, 1 ; pectoral $1\frac{2}{3}$; ventral $1\frac{3}{4}$.

Purplish-gray above, pale to whitish below or on under surface of head and abdomen. Spinous dorsal neutral-black, with scattered pale dots. Soft dorsal and caudal dusky, dark terminally. Pectoral and anal dark grey, former with upper edge narrowly dusky. Ventral disk whitish, with outer rays grayish. Sides of head all finely dotted with dusky. Traces of about 7 slightly oblique deeper brown cross-bands. One from Madras, 112 mm.

Ctenogobius horai new species.

Head $3\frac{1}{2}$; depth $5\frac{1}{4}$; D. vi—i, 9, i ; A. i, 9 ; scales 27 from gill-opening above to caudal base medianly and 3 more on latter ; 8 scales transversely from soft dorsal to anal origin ; snout 4 in head ; eye 3 ; maxillary $2\frac{1}{5}$; interorbital $2\frac{1}{3}$ in eye.

Body well compressed, elongate and tapering slightly back from spinous dorsal origin, where greatest depth. Caudal peduncle well compressed, least depth 2 in its length or $2\frac{1}{8}$ in total head length.

Head moderate, cheeks little swollen, width $1\frac{1}{2}$ in its length. Snout obtuse, convex over surface and in profile, length $\frac{3}{5}$ its width. *Eye*—large, slightly impinging on upper profile, center at first third in head; diameter greater than snout. Mouth moderate, closed mandible even with upper jaw tip. Mandible shallow. Maxillary reaches opposite first third of eye, rather slender. Teeth minute, slightly even, conic, in very narrow bands or rows in each jaw ; 1 or 2 close-set recurved canines each side of mandible. Tongue little rounded convexly in front. Front nostril small pore at first $\frac{2}{5}$ in snout length ; hind nostril simple pore little nearer front nostril than eye. Interorbital very narrow, with slight median groove. Preopercle edge entire, without fringe or spine. Gill-opening restricted, only extends opposite last fourth in head. *Gill-rakers*—2 + 5, short points, scarcely $\frac{1}{3}$ of gill-filaments, which $1\frac{3}{4}$ in eye. Isthmus broad. *Scales*—absent from predorsal, apparently from prepectoral and chest. Scales on trunk very caducous, most all fallen. Row of fine papillae from behind eye and along its lower edge ; 2 rows horizontally across cheek and another below extended forward on mandible below, also vertical row down opercle anteriorly.

Fins—Spinous dorsal origin little behind that of pectoral, spines rather flexible and fin rounded, none produced as filaments ; third spine $1\frac{2}{3}$ in head. Soft dorsal origin little nearer caudal base than snout tip, rays graduated posteriorly, where ending in point not quite reaching caudal base; eighth ray slightly less than head. Anal origin little behind that of soft dorsal, fin similar ; eighth ray $1\frac{1}{4}$ in head. Caudal ends in median point behind, $2\frac{3}{4}$ in combined head and trunk. Pectoral with upper rays not silky or detached, reaches anal, $3\frac{2}{5}$ in head. Ventral reaches vent, which short space before anal ; equals head.

Colour—in alcohol pale brownish generally. About 13 transverse whitish lines on trunk, darker interspaces greatly wider. Vertical fins and ventral dusky, at least terminally. Spinous dorsal with black blotch behind middle. Caudal with traces of transverse darker bands. Pectoral pale.

Length 30 mm. One example from Tuticorin. This species is unique among those of its genus in the transverse light lines on its trunk.

Named for Dr. Sunder Lal Hora, the accomplished Ichthyologist of the Indian Museum.

Ctenogobius tuticorinensis new species.

Head 3 ; depth 4 ; D. vi—i, 9, i; A.i, 8, i; scales 28 from gill-opening above to caudal base and 3 more on latter ; 11 scales transversely from soft dorsal origin to that of anal ; 9 scales along side of predorsal to gill-opening ; snout $3\frac{2}{5}$ in head measured from upper jaw tip ; eye 3: maxillary 3 ; interorbital $3\frac{2}{3}$ in eye.

Body elongate, compressed, deepest at spinous dorsal origin and tapering back moderately. Caudal peduncle well compressed, least depth $1\frac{2}{5}$ in its length or 3 in total head length. Head large, robust, width $1\frac{7}{8}$ its length, cheeks but little swollen. Snout convex, obtuse, length $\frac{3}{5}$ to $\frac{2}{3}$ its width. *Eye*—large, slightly impinging on upper profile, much greater than snout. Mouth large, mandible slightly protrudes. Maxillary about reaches opposite front of pupil, narrow. Teeth small, conic, in 2 rather wide-set rows in each jaw, outer little enlarged, at least anteriorly; outermost mandibular slightly recurved canine ; no teeth on palate or tongue which latter convexly rounded in front. Nostrils well separated ; front one at last $\frac{2}{5}$ in snout ; hind one close before eye. Interorbital very narrow, concave. Preopercle edge entire, without fringe or spine. Gill-opening extends forward about last fifth in snout. *Gill-rakers*—4 + 6. lanceolate, $\frac{3}{4}$ of gill-filaments, which $2\frac{2}{5}$ in eye. Isthmus wide. Head scaleless, also predorsal. Caudal base scaly, also chest and belly. *Scales*—with 12 to 15 basal radiating striae ; apical denticles 11 or 12 + 12 to 14, in one row ; circuli fine basally. Cheek with 3 rows of fine papillae horizontally, now along preopercle edge and mandible ; 4 longitudinal predorsal rows.

Fins—Spinous dorsal origin about over first third of depressed pectoral, fin rounded, spines rather flexible ; third spine $1\frac{7}{8}$ in total head length. Soft dorsal orgin midway between hind eye edge and caudal base, rays graduated down to last, first longest or $1\frac{4}{5}$ in head. Anal origin opposite that of soft dorsal, seventh ray longest, $1\frac{3}{4}$ in head. Caudal with median rays longest, rounded, slightly shorter than head. Pectoral without upper rays silky or free, reaches vent ; $1\frac{2}{5}$ in head. Ventral reaches vent, which shortly before anal, $1\frac{1}{4}$ in head.

Colour—in alcohol pale brownish generally. Sides and back with variegated waved deeper brown blotches, bars or short lines, on back as 2 pairs of predorsal transverse bands, then 4 broader deeper saddles. Alternating on side 4 deep. blotches of dusky brown, little below median axis forward, where first on opercle. Fins all pale generally. Spinous dorsal with 2 dusky-black horizontal bands, upper terminal. Soft dorsal with few rather large dusky blotches, also 2 or 3 series on caudal. Anal with basal and submarginal horizontal blackish line. Dark band from lower front eye edge to middle of maxillary. Length 48 mm. One from Tuticorin.

Among the species of *Ctenogobius* this may be known by its large eyes and contrasted dark blotches on the trunk.

Also 7 other examples, same data, which show the following : Head 3 to 3 ; depth $4\frac{1}{4}$ to $4\frac{2}{3}$; D. vi or vii—i, 9, i or 10, i ; A. i, 8, i ; scales 29 or 30 from gill-opening above to caudal base medianly, with 3 or 4 more on latter ; 12 scales transversely between soft and dorsal and anal origins ; 8 to 10 predorsal scales laterally to gill-opening ; snout $3\frac{1}{2}$ to $3\frac{3}{4}$ in head measured from upper jaw tip ; eye $2\frac{2}{3}$ to 3 ; maxillary $2\frac{2}{5}$ to $2\frac{4}{5}$; interorbital $2\frac{1}{4}$ to $3\frac{1}{2}$ in eye. Length 27 to 48 mm.

Ctenogobius cyanomos (Bleeker).

Head $3\frac{2}{5}$ to $3\frac{1}{2}$; depth $4\frac{1}{2}$ to $5\frac{1}{4}$; D. vi—i, 10, i ; A. i, 8, i or 9, i ; scales 27 to 30 from gill-opening above to caudal base medianly and 3 to 7 more on latter ; 9 or 10 scales transversely from soft dorsal to anal origin ; 10 to 18 predorsal scales ; snout $3\frac{1}{4}$ to $3\frac{3}{4}$ in head ; eye $3\frac{2}{3}$ to $4\frac{2}{5}$, maxillary $2\frac{1}{2}$ to $2\frac{3}{4}$; interorbital 8 to 10, or $1\frac{3}{4}$ to $2\frac{1}{5}$ in eye.

Body elongate, well compressed, deepest at soft dorsal origin. Caudal peduncle well compressed, least depth $1\frac{1}{2}$ its length or $2\frac{2}{5}$ to $2\frac{3}{5}$ in head. Head width 1 to $1\frac{2}{3}$ its length. Snout obtusely convex, length $\frac{2}{3}$ its width. *Eye*—large, very slightly impinging on upper profile, hind edge midway in total head length, diameter equals snout. Mouth large, little inclined, lower jaw shorter. Maxillary reaches first third in eye, rather slender. Teeth in villiform bands in jaws, with outer enlarged chiefly anteriorly, in mandible as single enlarged canine each side; no teeth on palate or tongue, latter rounded in front. Nostril at last fourth in snout. Interorbital narrow, level. *Gill-rakers*—3 + 5, lanceolate, $\frac{1}{3}$ of gill-filaments, 2 in eye. *Scales*—with 7 to 19 radiating basal striæ; apical denticles in row of 15 to 24 + 17 to 19; circuli moderate. Predorsal scales extend only about half way to eyes, variously completed and head otherwise naked; chest, belly and prepectoral base scaly. *Fins*—Second dorsal spine 2 to $2\frac{1}{10}$ in head, spines flexible; ninth dorsal ray $1\frac{7}{8}$ to $1\frac{9}{10}$; eight anal ray 2 to $2\frac{1}{10}$; caudal rounded behind, 1 to $1\frac{1}{10}$; pectoral rays all firm, none silky, $1\frac{1}{5}$ to $1\frac{1}{3}$; ventral $1\frac{1}{6}$ to $1\frac{1}{3}$.

Colour—Pale brown generally, edges of scales on back all slightly deeper brown. About a dozen narrow saddle-like blotches of deep brown down middle of back. Row of about 6 median deep brown blotches along side, last at caudal base. Dark line from behind eye to deep brown suprascapular blotch. Fins all pale. Spinous dorsal with deep brown blotch medianly, little back. Caudal with many transverse dusky or brownish streaks. One from Madras 61 mm., and 15 from Tuticorin 41 to 68 mm.

This species may be known by the combination of the uniform pale or white ventrals, included mandible and row of dark median rounded lateral spots.

My largest example has the third dorsal spine prolonged in a filament nearly long as head. Day's figure shows it greatly longer or estimated to reach base of last dorsal ray. None of my examples carry the pair of symphyseal mandibular barbels as Day describes and figures. He gives the jaws of equal length, though in my examples, the lower is usually a little shorter. All my examples also differ in that a median lateral row of darker spots is present, most distinct in the smaller ones, though at least present in all and possibly intensified to a more or less extent through formaline or other preservative fluids. The largest examples have the outer submarginal portion of the ventrals broadly blackish, much paler in smaller examples. The largest specimens also show a dark slaty line, variously distinct, from the lower front eye edge to the hind end of maxillary. All most all have about 6 dark brown median predorsal blotches to the eyes, the anterior 3 or 4 of which are usually paired.

Ctenogobius viridipunctatus (Valenciennes).

Head $3\frac{1}{4}$ to $3\frac{2}{6}$; depth 4 to $4\frac{1}{3}$; D. v or vi—i, 10, i; A. i, 9, i; scales 35 or 36 from gill-opening above to caudal base medianly and 4 more on latter; 11 scales transversely between soft dorsal and anal origin; 30 to 32 predorsal scales; snout $3\frac{4}{5}$ to 4 in head measured from upper jaw tip; eye 4 to $4\frac{4}{5}$; maxillary $2\frac{1}{3}$ to $2\frac{2}{5}$; interorbital $1\frac{1}{2}$ to $2\frac{1}{2}$ in eye.

Body compressed, deepest at middle of spinous dorsal. Caudal peduncle compressed, least depth $1\frac{1}{4}$ to $1\frac{1}{3}$ in its length or $2\frac{1}{5}$ to $2\frac{3}{4}$ in total head length. Head width $1\frac{2}{3}$ to $1\frac{3}{4}$ its length. Snout obtuse, length $\frac{3}{5}$ to $\frac{2}{3}$ its width. *Eye*—center at first $\frac{2}{5}$ in head length, at first third in younger examples; diameter equals or slightly less than snout. Mouth large, mandible slightly protruded. Maxillary oblique, reaches $\frac{2}{5}$ to $\frac{1}{2}$ in eye, narrow. Teeth biserial, usually outer row more or less larger; wide-set pair of upper canines and pair close-set or single each side of mandible, little recurved; no teeth on palate or tongue, latter convex in front. Front nostril lower, in cutaneous tube about midway in snout; hind nostril simple pore, about last fourth in snout. Interorbital narrow, concave. *Gill-rakers* 3 + 12, lanceolate, $\frac{1}{4}$ of gill-filaments, which half of eye. *Scales*—with 12 to 18 basal radiating striæ; apical denticles 26 to 33 + 22 to 32; circuli fine. Predorsal with finely crowded scales and caudal base finely scaled. Cheeks with 3 rows of fine papillæ horizontally, uppermost along lower eye edge and intermediate spaces with many short vertical series; row along preopercle edge out over mandible. *Fins*—Second dorsal spine $2\frac{1}{10}$ to $2\frac{1}{8}$ in head; seventh dorsal ray $1\frac{4}{5}$ to $1\frac{7}{8}$; eighth anal ray $1\frac{3}{4}$ to 2; caudal with median rays longest, rounded behind, 1 to $1\frac{1}{10}$; pectoral without free silky rays above, $1\frac{1}{5}$ to $1\frac{2}{5}$; ventral $1\frac{1}{3}$ to $1\frac{1}{2}$.

Colour—Brown above, pale to whitish below. Upper surface with 6 transverse predorsal deep brown bars and as many obscure saddles for rest of extent of back. Alternating along side 6 median lateral deep brown blotches, with small dark spot at caudal base medianly. Dusky streak from eye to suprascapula, ending in black blotch. Another from lower eye edge to middle of pectoral base, also dark blotch on cheek below and on preorbital. Dark blotch on opercle above and upper prepectoral. Dorsal grayish, spinous fin with broad dusky base. Soft dorsal with submarginal dark line and another median longitudinally. Anal grayish, with median longitudinal dusky line. Caudal variegated dusky, darker behind, upper edge pale. Pectoral pale. Ventral dusky. Six from Tuticorin 50 to 78 mm.

Ctenogobius griseus (Day).

Head $3\frac{1}{4}$; depth 4; D. vi—i, 10, i; A.i, 9, i; scales 33 from gill-opening above to caudal base medianly and 5 more on latter; 11 scales transversely from soft dorsal origin to that of anal; 30 predorsal scales; snout 4 in head measured from upper jaw tip; eye $5\frac{1}{3}$; maxillary $2\frac{1}{5}$; interorbital $5\frac{1}{3}$.

Body elongately ovoid, well compressed, deepest at spinous dorsal origin. Caudal peduncle well compressed, least depth $1\frac{1}{5}$ its length or $2\frac{3}{5}$ in total head length. Head width $1\frac{3}{5}$ its length. Snout convex over surface and in profile, length $\frac{2}{3}$ its width. *Eye*—small, center in first third of total head length; diameter $1\frac{1}{5}$ in snout. Mouth oblique, mandible protruding. Maxillary reaches eye center, slender. Teeth fine, in narrow bands in jaws, outer row in each little enlarged; mandible with slightly larger recurved lateral canine each side; no teeth on palate or tongue, latter rounded convexly in front. Nostrils not very distinct, front one about last $\frac{2}{5}$ in snout. Interorbital slightly concave. *Gill-rakers*—5+12, lanceolate, slightly less than gill-filaments, which $1\frac{2}{5}$ in eye. Scales with 11 or 12 basal radiating striæ; apical denticles in row of 16 to 20+16 to 18; circuli fine. *Scales*—finely crowded on predorsal, also on caudal base, few on opercle. Cheek with 3 horizontal rows of fine papillæ, row below eye and back to suprascapula; 4 short rows parallel and longitudinal on occiput; row along preopercle edge and mandible. *Fins*—Third dorsal spine $2\frac{2}{5}$ in head; ninth dorsal ray 2; eighth anal ray 2; caudal with median rays longest, $1\frac{1}{8}$; pectoral $1\frac{1}{3}$, ventral $1\frac{1}{2}$.

Colour—Brown generally, lower surface of head and abdomen but little paler. Few scattered deep brown dots on side of abdomen. Fins grayish-dusky, all darker or blackish terminally. Ventral largely dusky-black. One from Tuticorin, 60 mm.

Differs a little from Day's figure in a more abrupt snout. His account gives slightly more scales.

Ctenogobius masoni (Day).

Head $3\frac{1}{3}$; depth $4\frac{1}{5}$; D. vi—i, 10, i; A i, 9, i; scales 26 from gill-opening above opercle to caudal base and 5 more on latter; 9 scales transversely between soft dorsal and anal origins; 26 predorsal scales; snout 4 in head measured from upperjaw tip; eye 6; maxillary $2\frac{1}{4}$; interorbital $6\frac{1}{4}$.

Body elongate, well compressed, deepest at spinous dorsal origin. Caudal peduncle well compressed, least depth $1\frac{1}{2}$ in its length or $2\frac{2}{3}$ in total head length. Head width $1\frac{3}{5}$ in its length. Snout conic, convex over surface, length $\frac{3}{5}$ its width. *Eye*—elevated, impinging on upper profile, center at first third in head. Mouth large, oblique, mandible protruding. Maxillary reaches opposite hind eye edge. Teeth in 3 or 4 rather irregular rows in jaws anteriorly, fewer laterally, conic, small; 4 small canines above anteriorly; small recurved canine each side below; no teeth on palate or tongue, front of latter obtuse. Front nostril about midway in snout, hind one close before eye. Interorbital very slightly convex, supraorbital ridges entire. *Gill-rakers*—2+7, feeble short points, greatly less than gill-filaments, which $1\frac{3}{4}$ in eye. *Scales*—with13 to 18 basal radiating striae ; apical denticles 17 to 20+17 to 20, in one row ; circuli fine. Scales smaller and crowded on predorsal. Large scales well over caudal basally. Head naked, except scales on occiput and few on opercle above. Prepectoral scales small. Cheek with 4 horizontal rows of fine close-set papillae. *Fins*—Second dorsal spine $1\frac{9}{10}$ in total head length, spines flexible ; first dorsal ray 2 ; eighth anal ray $1\frac{2}{3}$; caudal (damaged) long as head at least, apparently rounded; pectoral $1\frac{1}{3}$, none of rays above silky or detached ; ventral $1\frac{1}{3}$.

Colour—Dull uniform brownish generally. Fins all dusky-neutral terminally. One from Madras, 60 mm.

Parachæturichthys polynema (Bleeker).

Head $3\frac{2}{5}$ to $3\frac{3}{4}$; depth $4\frac{3}{4}$ to 5 ; D. vi—i, 10, i ; A. i, 9, i ; scales 30 or 31 from gill-opening above to caudal base medianly and 4 or 5 more on latter ; 9 or 10 scales between soft dorsal and anal origins ; 16 or 17 predorsal scales ; snout $3\frac{2}{5}$ to 4 in head measured from upper jaw tip ; eye $4\frac{2}{3}$ to 5 ; maxillary $2\frac{1}{2}$ to $2\frac{3}{4}$; interorbital 5 to $5\frac{1}{2}$.

Body elongate, well compressed, deepest about middle of spinous dorsal. Caudal peduncle compressed, least depth $1\frac{1}{2}$ its length or $2\frac{1}{2}$ in total head length. Head width $1\frac{1}{4}$ to $1\frac{1}{3}$ in its length. Snout broadly convex, length $\frac{3}{5}$ to $\frac{2}{3}$ its width. *Eye*—superior, center near first $\frac{2}{5}$ in total head length ; diameter $1\frac{1}{8}$ to $1\frac{1}{5}$ in snout Mouth large, broad, mandible slightly protruding. Maxillary reaches little beyond front of eye, not quite to pupil, narrow. Teeth fine, conic, in narrow bands in jaws, outer row little enlarged, with 10 or more in front of each jaw more or less conspicuous, especially outermost of mandible ; palate and tongue toothless, latter broadly rounded in front. Row of 7 short filaments along each mandibular ramus below. Nostrils well separated ; front one about midway in snout ; hind one close above upper front eye edge. Interorbital slightly convex. *Gill-rakers*—5 + 8, clavate, about half of gill-filaments, which $1\frac{3}{4}$ in eye. *Scales*—with 10 to 12 basal radiating striae ; apical denticles 37 to 43 by 41 + 43, in one row ; circuli very fine. Head largely scaly, except muzzle. Cheeks with 5 horizontal rows of papillae, row from below eye and behind to suprascapula, another along preopercle edge and mandible. *Fins*—Third dorsal spine 2 in head ; eighth dorsal ray $1\frac{1}{3}$ to $1\frac{1}{2}$; seventh anal ray $1\frac{1}{3}$ to $1\frac{1}{2}$; ventral $1\frac{1}{3}$. Caudal ending in long median point behind, $2\frac{1}{6}$ to $2\frac{1}{5}$ in combined head and trunk ; pectoral $3\frac{2}{5}$ to $3\frac{1}{2}$.

Colour—Body olivaceous above, paler or whitish on under surface of head and abdomen, with 4 obscure deeper blotches along back. Fins neutral-dusky, especially marginally. At bases of uppermost caudal rays black ocellus, little larger than eye and bordered with whitish. Three from Madras, 135 to 140 mm.

Odontogobius bynœnsis (Richardson).

Head $3\frac{1}{4}$; depth $4\frac{1}{3}$; D. vi—i, 13, i ; A. i, 12, i ; scales 50 from gill-opening above to caudal base medianly and 5 more on latter ; 15 scales between soft dorsal and anal origins ; snout $4\frac{1}{10}$ in head ; eye $3\frac{1}{3}$; maxillary $3\frac{1}{2}$; interorbital 5.

Body moderately elongate, well compressed, deepest at middle of pectoral. Caudal peduncle well compressed, least depth equals its length or 2 in head. Head width $1\frac{3}{4}$ its length. Snout widely convex, length about $\frac{2}{5}$ its width. *Eye*—large, close to upper profile, hind edge midway in head. Mouth small, mandible slightly included. Maxillary slender, reaches opposite front pupil edge ; width $1\frac{1}{3}$ of eye. Teeth in about 2 rows, at least in mandible, finely conic ; mandible with recurved tooth each side medianly ; no teeth on palate or tongue, which rounded and fleshy in front. Nostrils small ; front one about midway in snout length ; hind one close before eye. Interorbital depressed, slightly concave, narrow. *Gill-rakers*—0+8, lanceolate, $\frac{2}{5}$ of gill-filaments, which $1\frac{1}{2}$ in eye. *Scales*—

with 7 to 9 basal radiating striæ ; apical denticles 10 or 11 + 10 to 14, in one row ; circuli fine. Head naked, except predorsal, from which all small scales now fallen ; breast and belly firmly scaled. *Fins*—Fourth dorsal spine $1\frac{1}{2}$ in head ; twelfth dorsal ray 2 ; eleventh anal ray $1\frac{2}{3}$; caudal apparently rounded behind, $1\frac{1}{8}$; pectoral 1 ; ventrals not cup-like, united, $1\frac{1}{4}$.

Colour—Brown above, paler below. Dorsals, anal and ventral dusky terminally. Pectoral and caudal pale, later with small round jet-black spot at base of upper median rays. Dusky streak from each side of snout tip to eye, then from back of last to suprascapula. Traces of dark blotch in prepectoral, before pectoral base. Back with about 7 obsolete vertical transverse dark bars. One from Tuticorin, 40 mm.

My example smaller than Day's figure, showing lower jaw shorter than upper, slightly fewer soft dorsal and anal rays and larger eye.

Oxyurichthys tentacularis (Valenciennes).

Head $3\frac{4}{5}$ to 4 ; depth $5\frac{1}{3}$ to $5\frac{2}{5}$; D. vi—i, 12, i ; A. i., 13, i ; scales 48 to 50 from above gill-opening to caudal base and 5 more on latter ; 14 to 16 scales between soft dorsal and anal origins ; 16 to 18 predorsal scales ; snout $3\frac{1}{3}$ to $3\frac{1}{2}$ in head measured from upper jaw tip ; eye $3\frac{1}{4}$ to 4 ; maxillary 2 to $2\frac{1}{4}$; interorbital $1\frac{7}{8}$ to 2 in eye.

Body elongate, compressed, deepest at spinous dorsal origin, rather slender. Caudal peduncle compressed, least depth 1 to $1\frac{3}{5}$ in its length or $2\frac{1}{5}$ to $2\frac{1}{2}$ in total head length. Head width $1\frac{4}{5}$ to $1\frac{7}{8}$ its length. Snout conic, length $\frac{2}{3}$ to $\frac{4}{5}$ its width. *Eye*—elevated, hind edge midway in head length ; diameter $1\frac{1}{4}$ in snout, slightly longer than snout in young. Mouth large, oblique, lower jaw protruding. Maxillary to first third in eye, to eye center in young. Teeth curved uniserial above ; lower ones biserial, rows widely spaced ; no canines ; no teeth on palate or tongue, latter pointed in front. Nostrils well separated ; front one small pore at first fourth in snout ; hind one much larger, higher, midway in snout. Interorbital narrowly concave. Fleshy pointed tentacle $\frac{2}{3}$ of eye at its upper hind edge, absent in small examples. *Gill-rakers*—3 + 8, lanceolate, $\frac{1}{3}$ of gill-filaments, which $1\frac{2}{3}$ in eye. *Scales*—with 29 to 36 basal radiating striæ ; apical denticles 12 to 17 + 13 to 15 ; circuli fine. Body scales small anteriorly, become larger posteriorly. Rows of fine papillæ across occiput close behind eyes, with 3 parallel rows each side, uppermost along each side of median low predorsal keel, lowest till above pectoral base and median about opposite half extent of opercle ; several short branches extend down from infraorbital ; on preorbitals extend down then bend suddenly back opposite front part of eye horizontally across cheek. *Fins*—Dorsal spines filamentous, third longest, $3\frac{1}{2}$ in combined head and trunk ; tenth dorsal ray $1\frac{1}{5}$ to $1\frac{1}{4}$ in total head length ; eleventh anal ray $1\frac{1}{3}$ to $1\frac{1}{2}$; ventral 1. Caudal ends in long slender point, $1\frac{3}{4}$ to $2\frac{1}{5}$ in combined head and trunk ; pectoral $2\frac{4}{5}$ to $3\frac{2}{5}$, long, pointed.

Colour—Brown, but little paler below. About 9 pairs of close-set saddles on back, first 2 pairs on predorsal. On side row of 6 rounded dark blotches and last as small round spot size of pupil at middle of caudal base, these blotches more or less joined forward with alternate dorsal saddles. Dorsals, anal and caudal pale, spotted with neutral dusky. Dusky bar across pectoral base. Dark brown infraorbital blotch. Pectoral brown. Ventral dusky. Twenty from Tuticorin 47 to 110 mm.

MONACANTHIDÆ.

Monacanthus setifer Bennett.

Head $2\frac{7}{8}$; depth at base of pubic spine $1\frac{1}{10}$; D. i—27 to 29 ; A. 28 or 29, P. 11 or 12 ; snout $1\frac{1}{3}$ to 1^{5} in head ; eye 3 to $3\frac{1}{10}$; interorbital $3\frac{2}{5}$ to 4.

Body well compressed, rather elongately ovoid. Caudal peduncle well compressed, without spines or armature, length $\frac{3}{4}$ to $\frac{4}{5}$ its least depth, which $2\frac{1}{2}$ to $2\frac{3}{4}$ in head. Head width $2\frac{1}{8}$ to $2\frac{1}{5}$ in its length. Snout compressed, profile straight, width at front of eyes $2\frac{1}{4}$ to $2\frac{2}{3}$ in its length. *Eye*—high, hind edge opposite that of gill-opening ; diameter $2\frac{1}{8}$ to $2\frac{1}{5}$ in snout. Mouth small, terminal, lips about even in front and cover teeth. Latter moderate, larger ones with slightly emarginate edges. Nostrils small, together, nearly level with upper rim of eye, front one little less than half of eye-diameter before front eye edge. Interorbital convex. Gill-opening $1\frac{1}{4}$ to $1\frac{1}{2}$ in eye. Body finely velvety to touch, little more granular around eye and on interorbital. *Fins*—Dorsal spine $1\frac{1}{5}$ to $1\frac{1}{4}$ in head, front edge and surface minutely asperous, hind edge each side with 11 antrorse serrae, some of lower bifid ; sixth dorsal ray $2\frac{1}{5}$ to $2\frac{1}{2}$; sixth anal ray $2\frac{1}{2}$ to $2\frac{7}{8}$; caudal rounded behind, $1\frac{1}{6}$ to $1\frac{1}{5}$; pectoral $2\frac{1}{8}$ to $2\frac{1}{4}$. Ventral ends in short movable spine with coronet of 5 denticles, 2 to $2\frac{3}{4}$ in eye ; its basal process with 4 denticles across front and 2 each side. Ventral flap moderate, not extending out beyond spine and roughened each side.

Colour—Grayish, with few obscure darker cloudings, usually as 2 blotches of darker on each rayed dorsal and anal and annectant region of trunk. Ventral flap little dusky. Fins all pale. Caudal with 2 darker transverse bands. Three from Madras, 68 to 77 mm.

AN ENCOUNTER WITH A FIGHTING TIGER.

By

Lt.-Col. R. W. Burton, I. A. (*Ret.*)

(*with a photo.*)

The shooting of a tiger is mostly a somewhat uneventful affair, of interest only to the sportsman himself and those who may be with him at the time. The present writer was fortunate early, last year, in bagging a tiger under, what may be correctly described, as somewhat exciting circumstances, which may be of interest to others besides himself, and the following account is taken from the shikar diary written up shortly after the occurrence. It is reproduced with the necessary polishing up and with a photograph.

In the month of February the fire lines of the Forest Reserves in the Sal forests in the Terai are burnt by the Forest Department, these operations include miles of grass land, covering certain areas which have also to be burnt as a protection to the adjacent jungles.

On the 24th February 1924 the shooting camp was comfortably settled for a few days at a Forest Rest House situated in one of these extensive open spaces which had recently been burnt. In this space, which is about 5 miles long, and averages a mile to two miles in width, is the Railway Station—the Forest Rest House being a mile to the east of it. The Railway runs through the clearing longitudinally, and two hundred yards north of the line, and about half a mile from both the Railway Station and the Rest House, is a patch of jungle more or less circular in shape and some 200 to 250 yards in diameter. Fire had been through the whole of this forest patch when the grassy plain was burnt some ten days previously, but some few patches of long grass remained unburnt, or partly burnt, and there were also evergreen trees and bushes here and there.

It was about seven o'clock when the elephant took me up the 85 feet fire line to the north to visit a buffalo which had been tied out on a cart track running through the forest, and this done, the heavy jungle to the west was searched for an hour or more with a view to finding some bears which were said to have been seen there the previous day. At about 9-30 the elephant emerged from the Sal forest into the burnt maidan, and it was decided to take this small patch of jungle on the way back to the Rest House.

When crossing the open space two pigs were seen going away from the patch of jungle and I remarked to the mahout that there might possibly be a panther there as it seemed curious that pig should be moving in the open at this time of the day. So we went quietly backwards and forwards on the alert for any movement. Almost on the east edge there was a small sambur stag which stared at the elephant with mild enquiring gaze and without alarm.

Quietly we turned and paced slowly on. Suddenly, where a moment before there was nothing,I saw a tiger about twenty-five yards away, which when sighted, was about to enter a small patch of very tall and dense grass which had mostly escaped burning. There was not much time to think; the first thought was that the tiger was not likely to remain long in such cover and, once lost sight of, would probably be well on the way to the main forest and give no chance. By the time the rifle was raised, a fraction of a second, all that was visible was the hind quarters, all forward of the loins being hidden by the grass. The tiger stopped for a moment, and I fired quickly seeing that my solid soft lead bullet (·500 black powder 5 drams) would probably rake forward and possibly kill the beast right away. At the shot the tiger gave a couple of grunts and disappeared. Circling the long grass we went into the open country, towards the main forest, in case the tiger should have gone on. There being no sign of him, and no tracks, we retraced our steps and began to search. Not finding the beast, it was necessary to circle back to find the place where the shot was fired and in doing so the cause of the tiger's presence in such a spot was discovered. The carcase of a sambur stag was at the edge of the thick grass into which the tiger had disappeared.

Marking the line which the animal would have taken in his rush when wounded we got round the grass and soon located our quarry by his deep rumbling growls which changed into the well known coughing grunts as he charged at the elephant from underneath some thick evergreen creepers and trees.

The old elephant, with visible marks on several parts of her wrinkled hide of previous encounters with wounded felines turned and bolted, with the tiger at her heels, giving me no chance of doing anything but cling on with my left hand to a rope and fire two ineffectual shots over her tail with my right. The *shikari* clung with both hands and well drawn up feet. Having put the elephant to flight the tiger drew up, with lashing tail, and it was seen that his off hind leg was badly damaged. Then he turned off into some partly burnt grass and was lost to sight. We could see that he was a large and massive tiger with fine ruff, and broad chest. His bow-legged appearance as he came on behind us was very marked. Also we saw that he had fine teeth and was exceedingly angry. So ended the first round.

The ancient mahout pulled up the equally ancient elephant within about fifty yards, and after a short rest we started to again draw the foe. Advancing slowly the obedient elephant pushed down several small trees to clear the arena. As each tree crashed, growls were elicited from amongst the grass, which could be seen shaking violently as the tiger tore at it in his rage. As we got within,what our opponent evidently considered the "ring" limit, out he came a second time and the performance was repeated. Again the elephant bolted; again the tiger pursued ; again my puny right arm let off two ineffectual shots. Let the reader sit on the edge of a sofa, without any rest for the feet and try to fire a heavy rifle with one hand. He will find that the weight of the rifle will release the trigger as the barrels are dropped to take aim.

On this occasion the tiger retired further into the grass, and there being no movement it could not be known exactly where he was. Two shots fired into the cover had no result, so the elephant again advanced, pushing down trees as before, and now, being herself somewhat excited, there was some difficulty in restraining her from advancing to do battle on her own account. Such a proceeding would very probably have had disastrous results, as she might have been pulled down on to her knees and one can imagine that any one or more of us might have been shaken off. The mahout was, however, equal to the occasion, and kept the elephant under control. I now told him that the only way would be for me to get into a tree and for the elephant to then draw the tiger and so give me a chance. It was obviously hopeless to attempt anything off the elephant.

Here it may be explained that there was only a pad on the elephant and no rests for the feet and those who have ridden on a pad elephant can realize that it is not easy to shoot off a pad at any time, when it is further explained that the writer is unable, owing to an injury of long standing, to sit astride, with one leg on each side of the mahouts back, as is usually done, then it can be well imagined what a hopeless affair it was to attempt to kill this rampaging tiger off old " Kandan Piari " running away with the action of a boat in a choppy sea.

But let us resume the stirring tale. The violent exertions of the elephant had caused the ropes securing the pad to get considerably loosened and the pad was slipping over to the right. It was necessary therefore for me to sit with my legs dangling over the left side : ready to pivot back to the right on the tiger sounding " active front" as firing the rifle at all with my left hand was quite impossible. I practised this manœuvre several times. This was necessary as my knees do not bend very much and my heels had to clear the mahout's head !

Before attempting any climbing into a tree, we had first to again locate the tiger so an advance was made from another direction, some more trees being pushed down, and we soon found ourselves within the tiger's fighting limits, and he came with the same horrid demonstrations and again the same proceedings on our part, except that this time the mahout pulled up too quick, or else the enemy had more pace, as he got home, as we found later, with the paw on the elephants near hind leg. I thought this had happened as I was unable to get off my usual second ineffectual shot because the furious beast was out of sight under the elephant's rump ! but I got off the second shot, both hands holding the rifle for the first time, as the tiger halted for a second before subsiding under the low hanging branches of an evergreen tree, and thought I might perhaps have hit him by a lucky fluke.

We now had the tiger in a better position as there was a small tree, close to a large one with a straight trunk, in which, if the tiger would allow me to take my stand, I could be ready for him when once more drawn by the now highly excited elephant.

The third round was over and the points were in our adversary's favour. Nine shots had been fired, the first only being a hit. Six ineffectual shots had been loosed off during the attacks and two into the grass to elicit indications of his whereabouts. Three cartridges only now remained.

Slowly the elephant was taken up to the desired tree and, naturally thinking it was to be pushed down, she was with difficulty restrained from demolishing it. There were several pushes and resulting anxious cracks on the part of the tree. We were on the very border of the " ring " and all this time the tiger kept up a continuous rumble. It was necessary to kneel on the pad, prepared to return instantly to the sitting position, should the charge be made. Several times it seemed to be imminent. At last there seemed to be a favourable moment and into the tree I got. Taking out of my pocket the length of cord always carried for such purposes, I quickly passed it round a branch of the tree and my waist : took the rifle and made ready. The movement of the elephant leaving the tree almost brought out the tiger. Seeing the leaves moving I very nearly got a shot but the chance was momentary and instantly gone. The distance was a short thirty yards.

The final round was now about to commence. It was after eleven o'clock and the first insulting challenge had been delivered at 9-40 a.m.

Once again the old elephant demonstrated, there was more pushing down of small trees, and after some little delay out came the tiger. I expected him across my left front but he took a short cut, as the elephant bore to my right, and my position was very awkward for firing. Both my shots missed ! The first ? I can't say why ! A branch of the tree arrested my arm as I pulled the trigger for the second barrel. The shots, however, seemed to have the effect of stopping the charge, a longer one than the previous three, and the tiger retreated some thirty yards as on the former occasions, and sat himself down not thirty feet away.

The opening of my rifle and the inserting of the twelfth and last cartridge attracted his attention. Looking up he peered malignantly at me round the trunk of a sapling. This prevented my aiming at his head. Just as well perhaps, head shots often go wrong. Ability to fire from either shoulder here came in, as on some previous occasions, as a very useful accomplishment. Leaning much to my right the strain taken by the waist cord and getting the butt of the rifle against the biceps of my left arm it was possible to get the sights on to his back, behind the shoulder and to left of the spine. To the shot the tiger subsided—he had been supporting himself on his forepaws his head fell back and his gallant fight was over.—

Eleven thirty a.m.—one hour and fifty minutes. No less gallant and beyond all praise was the conduct of old Ghulab the mahout who kept his head and managed his elephant admirably, throughout. Not once did he suggest a retreat, or urge, as he might have done, that he could not risk his elephant, and the old elephant—Kandan Piari—what of her ! Had she been permitted she would have been on top of the enemy. Twice before had she been mauled by a tiger. The shikari behaved well also though all he had to do was to cling on : he did that without unnecessary fuss !

The fight is over: now for the measurements. Laid on his back—nose pressed down and knives stuck into the ground at nose—root of tail—tip of tail gave a straight line measurement of nine feet one inch, the curve measurement being nine feet seven inches. The tail was two feet nine inches. The girth fifty-five inches. A massive tiger and beautifully marked.

The initial shot, and the last shot, were the only ones that hit the beast. The first shot fired when only hind quarters and a bit of the flank visible, could not, short of killing the animal outright, have been better placed. It entered at centre of buttock and smashed the thigh bone to pieces a few inches below the hip socket. It was found mushroomed perfectly, against the skin inside the stifle, and, had the penetration been sufficient, would have travelled forward and traversed the stomach to the vital parts of the chest. A·470 high velocity bullet would probably have done this and deprived our readers of this exciting tale. Had the hindleg not been broken we might have fared less fortunately than we did.

I wanted the carcase of the sambur left alone as quite possibly a prowling panther might have been found near it on some other day: but some Thadus, members of that curious tribe which inhabit the Terai forests, skinned and cut it up and brought the malodorous remains for me to see !

The stag had been killed about four days previously and had not been eaten at all: after killing, the tiger had gone for a walk and killed another sambur elsewhere. His stomach contained skin and hair of sambur showing this to have been the case. His return to inspect the first kill was his undoing.

The morning after this exciting day I asked the old mahout if he and his elephant had slept well. He replied that he had slept but little! I own that I was so excited as not to be able to get to sleep until near midnight. Such incidents as this live in one's memory. They come but seldom: but all sportsmen who persistently adventure in pursuit of dangerous game have experienced incidents of the nature here recited and the best one can wish them is "Good hunting" and many more like them—all with equally satisfactory results.

INDIAN DRAGONFLIES.

BY

MAJOR F. C. FRASER, I.M.S., F.E.S.

Part XXI.

(*With one Plate and* 1 *Text-figure.*)

(*Continued from page* 405 *of Vol. XXX.*)

Genus—GOMPHUS Leach.

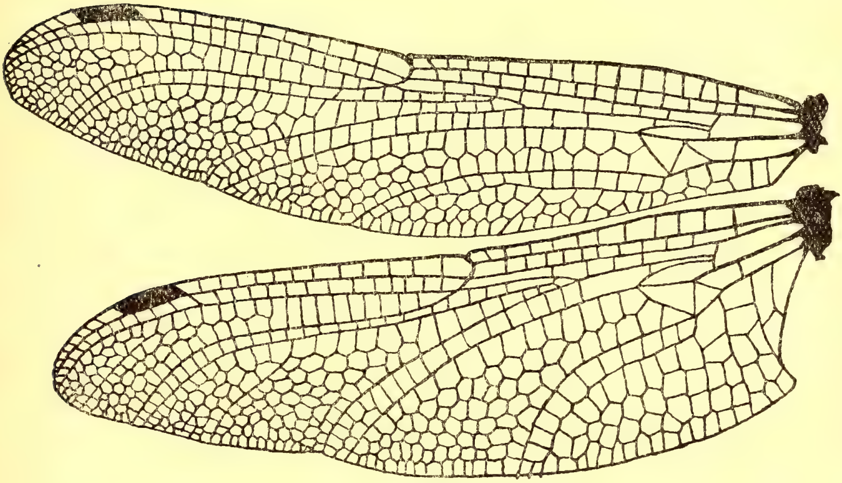


Fig. I—Wings of *Gomphus personatus* Selys. Male.

Gomphus. Leach, Edinb. Encycl., ix., p. 137 (1815); Selys, Bull. Acad. Belg., xxi., (2) p. 44 (1854); id. Mon. Gomph., p. 115 (1857); Will. Proc. U.S.Nat. Hist. Mus., xxxiii, p. 304 (1908); Selys, Mon. Lib. Eur., pp. 77-80 (1840); id. Revue des Odonates, pp. 81 and 82 (1850).

Aeshna. Fabr. Syst. Ent. p. 424 (1775); Latr. Gen. Crust. Ins., iii., p. 286 (1802); Kirby Cat. Odon., p. 64 (1890).

Diastatomma pars. Burm. Handb. Ent., ii p. 831 (1839); Charp. Lib. Eur., p. 15 (1840).

I have based the characters of this genus on a comparative examination of the following species, for the American examples of which I am indebted to Mr. E. B. Williamson of Bluffton, Indiana: *Gomphus personatus* Selys, *G. nilgiricus* Laid., *G. o'doneli* Fras., *G. nevadensis* Kenn., *G. ventricosus* Walsh, *G. fraternus* Say, *G. vastus* Walsh, *G. grasinellus* Walsh, *G. olivaceus* Selys, *G. sobrinus* Selys, and *G. donneri* Kenn.

The first three species are the sole representatives in India of this large genus, the other eight species mentioned are all from America. *G. personatus* and *nilgiricus*, by reason of the preponderance of the coal black ground-colour, stand rather apart from American examples of the genus, but *o'doneli* agrees with the latter, not only by the large extent of its yellow markings, but also by its robust, stocky build. *Gomphus promelas* Selys and *G. ceylanicus* Selys belong to Laidlaw's genus *Heliogomphus*, the former being synonymous with

Heliogomphus pruinans Fras. *Gomphus o'doneli* is from Bengal, *G. personatus* from Assam and Upper Burma, whilst *G. nilgiricus* is from the Western Ghats of India. With the exception of the three Indian species and a few neotropic in distribution, the majority of the species are palæarctic and nearctic, and are found widely distributed throughout Europe and North America.

CHARACTERS OF THE GENUS.

Moderately large to large insects, with body colouring of black marked with yellow. Wings hyaline, reticulation close, base of hind wing of male rather deeply excavate, tornus prominent. Arc usually between antenodals 1 and 2, occasionally opposite 2, more rarely a little distal of 2 ; two rows of postanal cells in forewing, 4 to 6 in the hind, the first postanal cell of hindwing entire, small and *extending basad for only about half the length of the base of subtrigone* ; 1 to 2 rows of cells between *Mi* and *Mia* ; pterostigma rather small, braced less, than one-fourth the length of distance between the node and outer end of pterostigma, only a single cubital nervure in all wings; 2 rows of discoidal cells in forewing widening to at least 3 rows at level of node ; 2 transverse nervures between *Mi-iii* and *Miv* in forewing, only 1 in the hind ; all trigones, subtrigones and hypertrigones entire ; *Cui* and *Cuii* in hindwing nearly parallel as far as hinder margin of wing.

Legs variable in length in the species, but hind femora always extending beyond hinder border of thorax and often as far as apical border of segment 1, less rarely overlapping segment 2, hind femora closely and minutely spined.

Body markings usually constant, but *personatus* shows considerable and wide variations.

Anal appendages of male equal, or subequal, both superior and branches of inferior widely and equally divaricate, simple, unbranched.

Genitalia variable in the species. Vulvar scale usually small and deeply cleft (but in *nilgiricus* it departs from type and is long and markedly projecting).

Genotype—*Gomphus vulgatissimus.* (Lin.)

Gomphus personatus Selys, Bull. Acad. Belg., (2) xxxvi, p. 197 (1873), ibid. (2) xlvi, p. 454 (1878), Will, Proc. U.S. Nat. Hist. Mus., Vol. XXXI, p. 305 (1908), Laid., Rec. Ind. Mus., Vol. XXIV, pp. 396-398 (1922).

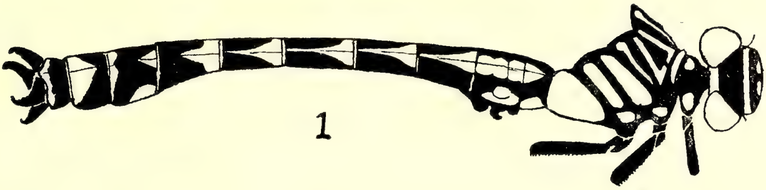
Gomphus xanthenatus. Will. l.c.p. 305-308 fig. 32 (1908).

Male : Abd. 42-45 mm. Hindwing 37-39 mm.

Head : labium with middle lobe blackish, lateral lobes yellow, labrum glossy black marked at the base with two oblong bright yellow spots, bases of mandibles yellow, ante-and post-clypeus black, the latter with a large lateral spot of yellow against the eye and a variable small medial spot of the same colour, frons bright greenish yellow except the lower part in front and its base above which is marked with a fine crenulate black basal line. Rest of head black but the occiput variably bright to dull yellow at its centre, black laterally, fringed with black hairs, very long in the male but shorter in the female. Occiput of male straight, in the female a little sinuous and usually with one or two small spines on either side, and with the yellow much more extensive than in the male.

Prothorax black marked with bright citron yellow, a broad anterior collar, a small medial spot and a much larger lateral one on the posterior lobe.

Thorax black marked variably with citron yellow as follows :—a mesothoracic collar slightly broken at its middle by the black middorsal carina, and confluent at its outer end with straight antehumeral stripes which run from the antealar sinus parallel with the dorsal carina, thus forming an inverted figure seven on each side, a variable humeral marking represented, in a slight majority of specimens, by a small upper spot, but in others by a sinuous stripe which expands



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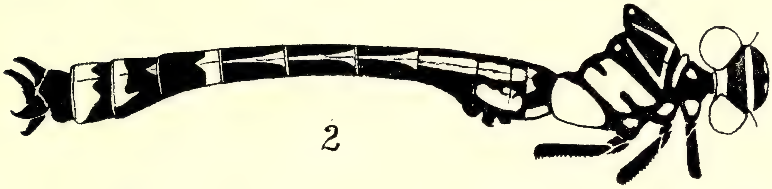

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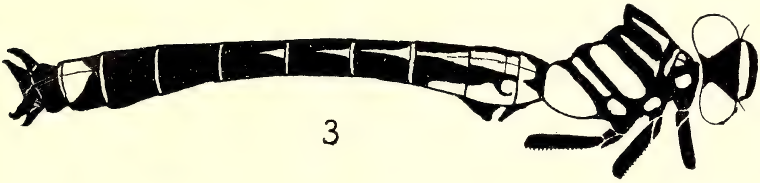

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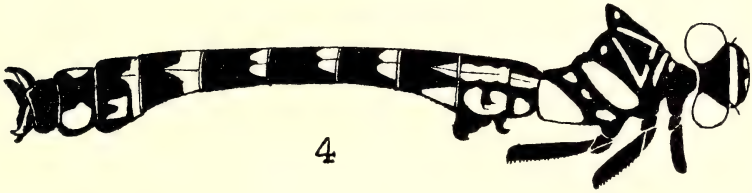

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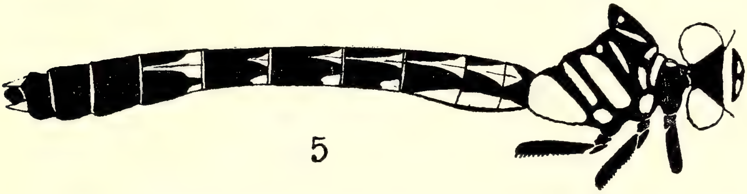

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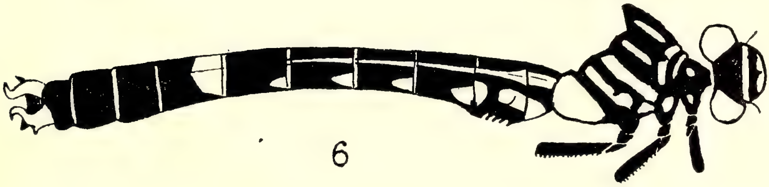

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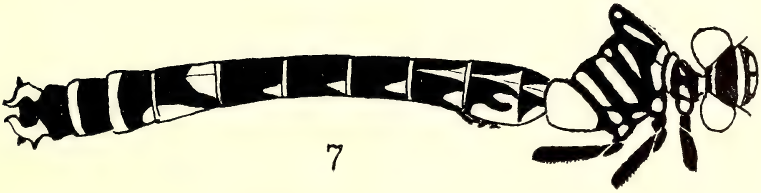

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INDIAN DRAGONFLIES.

For explanation see on the reverse.)

INDIAN DRAGONFLIES.

Explanation of the Plate.

1. Gomphus personatus ♂ from Maymyo.
2. Gomphus personatus ♂ from Shillong.
3. Gomphus nilgiricus ♂
4. Gomphus o'doneli ♂
5. Heliogomphus ceylonicus ♀
6. Heliogomphus promelas ♂
7. Heliogomphus nietneri ♂

The size of the figures is purely arbitrary, measurements are given in the text. Fig. 5 is constructed from the Selysian description, the other figures are drawn from life.

into an upper spot and which may be broken at its middle. In Shillong specimens both forms are met with ; in a pair taken by Col. F. Wall at Maymyo, Upper Burma,the stripe is well formed, in Williamson's variety *xanthenatus* from Burma, the stripe is absent in three specimens, incomplete and broken in a fourth. Laterally more or less broadly yellow marked with two narrow black lines on the lateral sutures.

In Williamson's *xanthenatus* these two lines are more or less confluent and almost obliterate the included yellow ; in the pair from Maymyo, the lines are well separated throughout their entire length by the yellow ; in Shillong specimens the line on the anterior suture is invariably broadly broken, being represented by a small upper section and a longer lower which begins at the spiracle. The line on the posterior suture is much finer and the lateral yellow correspondingly much more extensive.

Legs black, anterior femora with a yellow stripe on the inner side, hind femora with a row of short, robust, moderately widely-spaced, gradually lengthening spines.

Wings hyaline, very palely and evenly enfumed ; pterostigma dark brown between black nervures ; costa reddish brown ; 2 rows of cells between *Mi* and *Mia* at level of outer end of stigma, but 4 rows at the apex of wing ; a basal incomplete antenodal nervure frequently present, in the Burmese pair from Maymyo it is present in three wings of the male but entirely absent in the female, in Williamson's Burmese specimens, it is present in all wings of two specimens, in the front wings only of another specimen and entirely absent in a fourth specimen. In Shillong material it is more rarely present and in four consecutive specimens examined, it was present in only one of the forewings of two specimens, absent in all other fourteen wings.

Anal triangle of 3 to 5 cells ; 4 to 5 rows of postanal cells in the hindwing; 3 rows of cells at level of node in the discoidal field ;

nodal index $\frac{14\text{-}18 \,|\, 17\text{-}15}{13\text{-}11 \,|\, 11\text{-}13}$, $\frac{12\text{-}14 \,|\, 15\text{-}12}{14\text{-}10 \,|\, 11\text{-}13}$; membrane obsclete.

Abdomen tumid at base and from segment 7 to 10, thin and cylindrical between these two parts, black marked with bright citron yellow as follows :—a broad continuous stripe on the sides of segments 1 to 3, tapering apical-wards on the latter segment and very short in the male, and not quite extending to apex of segment in the female, a large apico-dorsal spot on 1, a trilobed stripe on dorsum of 2 extending the whole length of segment, a fine dorsal carinal stripe on 3 tapering apicad and with a slightly crenate edge, segments 4 to 6 with small baso-lateral spots and larger baso-dorsal triangular spots which taper along the carinal ridge for a variable distance, on segment 7 these spots are confluent to form a basal annule which extends for a short distance apicad along the carina, markings on segment 8 extremely variable, usually a narrow apical ring which expands on the sides into a triangular point directed basad, a small triangular baso-dorsal spot, and a largish ventro-lateral elongate spot. Variations of this pattern exist as a complete absence of the apical ring, or two irregularly shaped lateral spots at the apex, the ventral spot may be very minute or entirely absent, the carinal spot may extend as far as the apical border and show a medial expansion, in short there seems to be no limit to the number of variations which these three markings may not assume. Segment 9 with a broad apical ring of variable thickness and extending nearer the base on dorsum than on the sides. In some specimens it extends as far as base of segment, in others it is quite fine and its basal border is serrated. usually however it covers about half the segment. Segment 10 entirely unmarked or more rarely with a fine broken apical ring.

Anal appendages as long as segment 10, of equal length and equally divaricate, black. The superior tapering to a point, curling evenly down nearly to apex which is directed abruptly straight back; inferior deeply cleft into two branches which lie parallel to the superiors, hollowed out above, curling evenly upward.

Genitalia: lamina cowl-shaped, projecting slightly; hamules very robust and projecting almost perpendicularly from the genital sac, their apices turning rather abruptly forward, black: lobe matt black, very large and tumid, projecting as a massive funnel-shaped organ.

Female. Abdomen 42 to 45 mm. Hindwing 38 to 42 mm.

Almost exactly similar to the male except in those points already mentioned above. The abdominal markings more extensive, thus the carinal stripe forms an almost complete stripe from segment 1 to 6 and is often confluent with the baso-lateral spots. Segment 8 has a fine apical ring and less rarely a small triangular baso-dorsal point. The apical border of segment 10, the anal appendages and a conical prominence between them yellow. In some, the anal appendages are black and marked with yellow on the dorsum only.

Vulvar scale not quite half the length of segment 9, bifid for about half its length, narrow and subtriangular.

Distribution. The type comes from the Khasia Hills, Assam and was described by Selys from a specimen with a complete humeral stripe. The above descriptions have been made from a large number of specimens collected by Mr. Bainbrigge Fletcher in the Khasia Hills, Assam (Shillong, during May and June), and from a pair collected at Maymyo, Upper Burma, by Col. F. Wall, in June, whilst Mr. Williamson's specimens come from the Toungoo and Karen districts of Burma. In regard to these latter specimens, it will be seen that they grade almost imperceptibly through the Maymyo specimens into the Shillong ones, the only real point of difference being the lateral sutural black lines which are complete in Burmese material, but invariably broken in Assam specimens.

I do not think that this slight difference is sufficient to constitute even a local race, so that they are here treated as mere varieties.

Gomphus nilgiricus Laid., Rec. Ind. Mus., l.c. pp. 397, 398, 419 and 420, fig. 16 and pl. xi, fig. 5 (1922); Fras., Rec. Ind. Mus., Vol. XXVI, pp. 476-477 (1924).

Male: Abdomen 46mm. Hindwing 35mm.

Head: labium pale brownish yellow; labrum, bases of mandibles and anteclypeus dark brown; postclypeus and front of frons black, upper part of frons bright greenish yellow, rest of head black.

Occiput black, slightly raised in the middle.

Prothorax black marked with citron yellow as follows:—an anterior collar, a transversely oval spot on the dorsum of hinder lobe and a small paired spot just in front of and confluent with latter.

Thorax matt black marked with greenish yellow as follows:—straight antehumeral stripes running parallel with the mid-dorsal carina, gradually broadening below where they are confluent with a widely interrupted mesothoracic collar. Laterally broadly greenish yellow marked with two moderately broad black stripes on the lateral sutures, often confluent with one another so as to split up the intervening yellow into two or three spots.

Legs black, robust, hind femora extending well on to the second abdominal segment, minutely and densely spined.

Wings hyaline, pterostigma braced, over 4 to 5 cells, dark brown between black nervures; nodal index $\frac{13\text{-}13}{15\text{-}\ 9}\Big|\frac{15\text{-}12}{10\text{-}13}$; membrane obsolete; 1 to 2 rows of cells between *Mi* and *Mia* at the outer end of pterostigma; 2 transverse nervures between *Mi-iii* and *Miv* in the forewing, only 1 in the hind; 5 to 6 rows of postanal cells in the hindwing, the first entire, extending basad for a little more than half the length of base of subtrigone ; a basal incomplete antenodal nervure variably present (present in both forewings of one male, in both forewings of two females, in all wings of two males, but apparently more often present in the forewing than hind) ; 2 to 3 rows of discoidal cells at level of node, usually 3 ; only 1 cubital nervure in all wings.

Abdomen tumid at base, moderately and squarely dilated from segment 7 to 10, slender and cylindrical between these parts, black marked with bright primrose yellow as follows :—the sides of segments 1 and 2 at and below level of oreillets, the latter margined with black, a dorsal spot on segment 1 widening apically, a trilobed band on mid-dorsum of segment 2, extending the whole length of segment, a mid-dorsal line on 3 tapering rapidly from its base and not quite reaching apical border of segment, a triangular basal spot on the sides of this segment, paired basal, dorsal spots on segments 4 to 7 and confluent with one another at the base, segments 8 and 10 unmarked but 9 with its apical half yellow, the border of this wide annule markedly crenate or serrate and resembling a similar marking seen in *personatus*.

Anal appendages black, about as long as segment 10, the superiors and branches of inferiors widely and equally divaricate, the superior tapering to a fine point, curved evenly down but the apex turned rather abruptly back and up ; inferior with its branches first directed down and then curling up, of the same length as superiors.

Genitalia : lamina depressed, broad and shallowly arched ; hamules very robust, broad at base, tapering to a point, projecting markedly from the genital sac with a slight posterior slope, black ; lobe large and prominent, funnel-shaped, black.

Female : Abdomen 43 mm. Hindwing 38-40 mm.

Closely similar to the male save for sexual differences. Abdomen thick and robust, cylindrical throughout.

Wings rather broader, pterostigma pale brown, over 4 to 6 cells ; nodal index considerably higher. Abdominal markings broader, the dorsal basal spots entirely confluent and continued along the mid-dorsal carina as fine lines. The basal lateral spot on segment 3 much larger, confluent with the lateral yellow on the two previous segments and continued nearly to apical end of segment. Segments 8 and 10 are unmarked as in the male, but 9 bears a similar broad apical ring. Unlike *personatus*, the markings of this insect are remarkably free from variation.

Vulvar scale of great length, projecting from the abdomen at an angle of about 45 degrees, consisting of two closely apposed scales, which taper from a moderately broad base to a fine point.

Anal appendages small, conical, black, the conical protuberance between them yellow.

Distribution.—A rare insect found sparcely throughout the Western Ghats of India. A few specimens have been taken on streams flowing down the Mettapalayam and Gudalur ghats, Nilgiris, I have taken 5 males at the head of the Sampaji river and on a small stream above the Hatti river, Coorg. Major Frere found it in larger numbers on the Bear and Cinchona streams, Kodai-kanal, Palnai Hills. The larva, which burrows in sand, is of the long, cylindrical, torpedo type. The female deposits her eggs by stabbing them into wet sand in the beds of rocky mountain streams. The range of this species seems to be confined to altitudes between 3,000 and 7,000 ft. The males are usually found settled on rocks in midstream or on cane fronds overhanging streams. It is the only Gomphine so far taken in the Palnai Hills, which may explain its greater prevalence there. In the Nilgiris and Coorg, it is faced with the formidable competition of *Lamellogomphus*, *Megalogomphus*, *Heliogomphus* and *Burmagomphus*.

Gomphus o'doneli Fras., Rec. Ind. Mus., Vol. XXIV, pp. 420-421 (1922).

Male: Abdomen 42 mm. Hindwing 30 mm.

Head: labium pale yellow, the middle lobe bordered with black; labrum glossy black with two small basal yellow spots; rest of face and head black except for a narrow transverse stripe of yellow on crest of frons. Occiput emarginate, fringed thickly with black hairs.

Prothorax black, the posterior lobe, a small spot on either side of it, a duplicated spot just in front of it and an anterior collar yellow.

Thorax black marked with yellow as follows:—oblique ante humeral stripes which are confluent with a slightly interrupted mesothoracic collar, a small upper humeral spot. Laterally the greater part of the sides yellow marked by a broad medial band of black which is itself marked by three small yellow spots. Most probably this black band originates from the fusion of two black stripes on the lateral sutures.

Legs short, robust, entirely black, Hind femora coated with small spine and with a single larger spine at the distal end.

Wings hyaline; pterostigma dark brown, braced, rather small; membrane almost obsolete, dark brown; 2 nervures between *Mi-iii* and *Miv* in the forewing, only 1 in the hind; only 1 row of cells between *Mi* and *Mia* at level of distal end of pterostigma; *Cui* and *Cuii* nearly parallel in the hindwing; nodal index $\frac{9\text{-}16}{11\text{-}10}\ \frac{14\text{-}\ 9}{11\text{-}10}$; 3 rows of discoidal cells at level of node in forewing; 3 to 4 rows of postanal cells in hindwing, the first postanal (the vestigial anal loop) very small, entire, extending inwards towards base of wing for only half the length of the base of subtrigone; no incomplete basal antenodal nervure in either sex.

Abdomen tumid at base, the base of segment 7 and 8 and 9 broadly dilated although not winged, segments 3 to 7 narrow and cylindrical.

Black marked with yellow as follows:—a triangular dorsal spot at apex of segment 1 and a broad lateral spot on each side, segment 2 with a trilobed dorsal stripe, the oreillet and a large lateral spot beyond it, 3 with the dorsum narrowly at the base and a large lateral basal spot, 4 to 6 with dorsal basal spots rather widely confluent across the carina, 7 with a broad basal annule prolonged apicad along the dorsal carina, 8 with a small spot on the middorsal carina at the base and another larger angulated spot on the middle of each side, 9 with the whole of the ventro-lateral border broadly yellow, 10 unmarked.

Anal appendages black, widely and equally divaricate, the superiors slightly longer than branches of inferior and about equal in length to segment 10, very robust, very thick at base, at first directed obliquely out, the apex then sharply angulated back so that the outer border presents a prominent angle, the apex itself rapidly tapering to a sharp point. Inferior deeply and broadly cleft into two strongly divaricate branches, short, broad and with the apex ending in a minute upturned spine.

Genitalia: lamina depressed, broad; hamules very robust, projecting almost perpendicularly from the genital sac, ending in a robust, slightly forwardly directed spine; lobe of great size, bulbous, funnel-shaped, black.

Female. Abdomen 42 mm. Hindwing 32 mm.

This sex which has not been described before, resembles the male in its robust stature and general colouring. The abdomen is a little thicker at the middle segments but is not of that even width generally seen in female gomphines. Differs from the male in the following respects:—In addition to the two small basal spots on labrum, there is another smaller but brighter spot on the outer side of each; the anteclypeus is very dark brown and there are two small median yellow spots on the lower border of postclypeus and a very obscure spot on the same structure at the border of eyes. The occiput is fringed with short black hairs, simple, its extreme edge brown, but behind, as seen by tilting the head forward, the occiput is bright yellow.

Prothorax and thorax similar but the mesothoracic collar barely interrupted and the upper humeral spot nearly obsolete. Legs black, the hind femora with a row of gradually lengthening, closely-set, very robust spines, the distal one of great length.

Wings similar to the male, nodal index not differing noticeably.

Abdomen with the basal spots so confluent as to form rather broad basal rings from segment 3 to 7, the mid-dorsal stripe on segment 2 tapering apicad more than in the male, the lateral spot on segment 8 not angulate but quadrat and extending to base of segment, an additional small baso-dorsal spot one segment 9 and the lower part of the sides of 10, as well as 9, yellow.

Anal appendages very small, pointed, yellow. Vulvar scale rudimentary merely a small broad short projection of the apical border of segment 8 but slightly overlapping 9 ; the expanded borders of the segments here functionate for the vulvar scale.

Distribution.—A single pair only of this rare species is known, which were collected by Mr. H. V. O'Donel at Hasimara Tea Estate, Duars, Bengal. In general facies they recall strongly species of the genus from North America and cannot be readily confused with either *personatus* or *nilgiricus.*

(Since the above was written, Mr. O'Donel has taken another male at Hasimarà.)

(*To be continued.*)

NOTES ON THE BIRDS OF THE SIKKIM HIMALAYAS.

By

HERBERT STEVENS, M.B.O.U.

PART VI.

(*With 2 plates.*)

(*Continued from page 379 of this Volume.*)

344. Elwes's Horned Lark. Otocorys alpestris elwesi. Blanf.

Recorded for Sikkim at nearly 18,000′ at which elevation Blanford met with this Lark. (Kongra Lama Pass between 15-16,000′. Donkia Pass, 18,000′.)

345. The Long-billed Calandra Lark. Melanocorypha maxima. Gould.

Recorded for the higher parts of Sikkim. Observed up to 15,200′ in Tibet. (Walton.)

346. The Tibet Skylark. Alauda arvensis leiopus Hume.

I have not been fortunate to meet with any species of Skylark in these hills, though I have a distinct impression of a crested Lark without any pronounced form and colour characters, seen in the winter of early March 1920 at 8,800′ in Lachung; this records might also in the circumstances refer to Galerida sp ? as it was not secured. Mr. N. B. Kinnear regards *Alauda inopinata* Bianchi as a purely Tibetan species; until specimens actually turn up from the Sikkim Himalayas for identification and comparison the status of any species of *Alauda* must remain very obscure. *A. inopinata* was obtained at Khamba Dzong at 15,000′ in June and July by the Mount Everest Expedition.

347. The Small Kashmir Skylark. Alauda gulgula guttata. Brooks.

Evidently obtained by Mandelli in June from somewhere in the far interior as Kinnear refers to four skins in the National Collection, one of which is from Sikkim.

348. The Rufous Short-toed Lark. Calandrella brachydactyla dukhunensis. (Sykes.)

I saw undoubted birds of a species of *Calandrella* or *Mirafra* and took their eggs at about 7,500′ in the Mai Khola in East Nepal, unfortunately I failed to secure any specimens. Blanford records it as common in all the higher valleys of Northern Sikkim above 12,000 especially abundant at Yumthang, 12,000′, Momay Samdong, 15,000′ and Phalung, 16,000′. " At the latter place early in October, the Short-toed Larks were in flocks of several hundreds just as they are found in March in the plains of India". These records refer to *Alauda brachydactyla* but might well include the next species. Obtained by the Mount Everest Expedition up to 17,000′.

Brook's Short-toed Lark. Calandrella acutirostris tibetana Brooks.

Obtained by the Mount Everest Expedition at 14,000′.

Possibly may occur in the extreme north which remark also applies to *Galerida cristata leautungensis* (Swinh.).

349. The Western White-eye. Zosterops palpebrosa elwesi. Stuart Baker.

Commonly and generally *distributed up to 5,000′* at all events. Occurs at Gopaldhara, 4,700′, during the cold-weather months ♂ 31-12-11. In all likelihood reaches an elevation of 7,000′ as recorded for the Himalayas.

350 The Himalayan Yellow-backed Sunbird. Æthopyga siparaja seheriæ (Tick.).

Recorded for the "Himalayas up to 7,000′ in summer". This elevation is entirely erroneous for the Sikkim Himalayas. *Confined to low elevations only* Entirely absent from the valleys of the foot-hills in the west which do not support a plains-fauna. Nurbong at 2,000′, 21-2-14, conspicuous by their numbers. Obtained in the Tista Valley up to an elevation of 3, 600′. (G. E. Shaw).

351. The Fire-tailed Yellow-backed Sunbird. Æthopyga ignicauda ignicauda (Hodgs.).

Irregularly distributed *from 2,000′ and undoubtedly lower on occasions, up to over 10,000′ in winter and higher in summer* Phalut, 11,800′, August. *This Sunbird ascends the highest of the several species represented in the Sikkim, "Himalayas."* "Observed by Blanford at 11,000′". Kalo Pokhari, Nepal-Sikkim Frontier, 10,160′ These sunbirds were often seen in parties during brief, sunny spells of weather haunting the birch and rhododendron trees, when in flower in late March and early April, all vegetation and the surroundings being enveloped in a coating of snow at this time. A drop in the temperature or the wafting up of the clouds would force them into the valley below. Nurbong, 2,000′, an immature male observed on the 20th of February and a similar male in March 1914. Eighteen specimens examined. Gopaldhara, 4,720′, ♂ 16-11-20 (a), juvenile no moult, breast suffused with orange-red, remainder of lower plumage greenish-yellow, rump yellow, upper tail-coverts crimson; in all other respects similar to the adult female. 4,700′ ♂ 28-12-11, (b), juvenile, similar to (a) with the exception that the red on the breast is wanting, the tail is margined externally with rufous, a few feathers on the upper surface showing signs of the change into the adult plumage. 4,720′, ♂ 16-11-20, (c), similar to (a) excepting the tail is margined externally with rufous, and one middle feather is 63 mm. longer than the next pair; evidently an abnormality for this juvenile stage of plumage. Kalo Pokhari, 10,000′, ♀ 18-3-12, partial moult on crown. 8,500′, ♂, 28-3-12, partial moult on crown and throat.

Kalo Pokhari, 10,000′, ♂ 18-3-12, partial moult, middle pair of tail feathers shorter than the remainder, measuring 30 mm. in total length. 8,500′, ♂ 19-3-12, in moult. Darjeeling, 6,500′, ♂ 13-304, partial moult. Gopaldhara, 6,000′, ♂ 10-3-18, in moult; ♂ 10-3-18, in moult; ♂ 10-3-18, in moult. These five specimens agree with the first specimen in respect to the middle pair of the tail feathers, which measure in the order taken, 24, 32, 24, 30 and 39 mm. respectively.

Kalo Pokhari, 10,160′, ♂ 17-3-12. adult, middle pair of the tail feathers longer than the next pair by 24 mm. ♂ 20-3-12; ♂, 22-3-12; ♂ 2-4-12; ♂ 3-4-12. These four adult specimens agree with the first specimen in having the middle pair of tail feathers longer than the next pair in the order taken by 19, 25, 16 and 26 mm. respectively. Five others collected, but not available for comparison; these did not vary in any appreciable extent from the average. Thus the elongated middle pair of tail feathers of the adult male; the measurement of which is given by Oates as exceeding the next pair in length by 2.7″=69mm. takes several months to reach their extreme length which is probably not attained before July and may not always be reached within the year, and this is further confirmed by an adult ♂ 11-8-05 showing a measurement of 61 mm. in this respect.

Blanford's record refers to the Cho La Range, 11,000′, August.

352. Mrs. Gould's Sunbird. Æthopyga gouldiæ gouldiæ (Vig.).

Uncommon. Found at *all elevations of from* 4,000′-10,000′ according to season. Once observed on the Mirik Ridge above Namsoo at an elevation of 4,000′, exact date overlooked, probably late March or early April. Kalo Pokhari, 10,160′, ♂ ♀ 17-3-12 ; ♂ ♂ 22-3-12. With the exception of one other female these specimens constituted the sum total of this Sunbird's appearance on the Ridge, which occurred during a few days of tropical heat ; they had come up from the densely wooded valley below, on the Sikkim side of the Frontier. Gopaldhara, 4,720′, ♂ 15-3-16,* ♂ 16-11-20, only this single male secured ; as I failed to discern the female which was in all likelihood mixed up with the numerous immature males and females of *Æ. ignicauda.* 3 ♂ ♂, ♀ 2-11-21. First arrivals, which appeared immediately the cherry blossom opened.

This Sunbird was much in evidence at this time, dwindling down gradually until the 13th of this month when the flowers had mostly set and the last bird had disappeared : two males are in partial moult not having yet attained the full adult plumage.

353. The Black-breasted Sunbird. Æthopyga saturata (Hodgs.).

Generally distributed. Occurs up to *an elevation of 6,000′* at all events in "the rains". During "the cold weather" it keeps to the warmer bottoms of the valleys. Gopaldhara, 4,720′ Only a few birds of this species are to be seen in this "Sunbirds' paradise" when the cherry trees are in blossom in November, as there is no appreciable augmentation of their numbers as is so noticeable with *Æ. ignicauda* and in some measure *Æ. gouldiæ* at this favourable time ; yet they frequent scattered cherry trees at lower limits to some extent along with *Æ. nipalensis.* During late April, I have seen odd birds probing the flowers of the cardamom at ground level.

354. The Nepal Yellow-backed Sunbird. Æthopyga nipalensis nipalensis. (Hodgs.).

Found at *all elevations of from 3,500′-10,000′* both in the Interior of Sikkim and on the Outer Ranges. Only recorded up to 6,000′ for the Himalayas. Gopaldhara, 3,500′, ♂ 17-1-19, the tail in this male has not acquired its full length. 4,700′, ♂ 24-12-11, the head, throat, breast and back are undergoing moult into the adult stage of plumage. Sonada, 6,500′, ♂ 6-2-17, adult. Lepcha Jagat, near Ghoom, ♂ 28-5-16*. Common around Singhik at an elevation of 4,600′ during the second week of March, 1920. Kalo Pokhari, Nepal-Sikkim Frontier, 7,000′-10,000′. A series of 10 ♂ ♂, 4 ♀ ♀ collected during March and April 1912 ; all of which are fully adult. Oates remarks the female is undistinguishable from the female of Æ. seheriæ. A comparison of a series of both species shows *Æ. nipalensis* to have the *back a more defined yellowish-green, the throat to breast to be darker than in any specimens* of *Æ. seheriæ,* also some females of *Æ. seheriæ* have *the mantle feathers tinged in places with red.* All these characters are easily discernable in well-prepared skins.

355. The Purple Sunbird. Cyrtostomus asiaticus asiaticus (Lath.).

A plains-species. Recorded as found up-to 5,000′ (Himalayas). This elevation is certainly not applicable to the typical form for Sikkim. It occurs in the

Eastern Dooars at Kumargram on the borders of Assam; where it does not encroach on the heavily forested region at the base of the hills. Specimens collected hereabouts in the plains in January 1922, have the back and upper tail-coverts of a steely-blue in comparison with the purple tone of specimens from farther west (Behar).

356. The Larger Streaked Spider-hunter. Arachnothera magna magna (Hodgs.).

Commonly occurs in the Rungbong Valley up to *an elevation of* at least 5,000′, wherever it can find the clumps of plantain trees in the folds of whose leaves it constructs its nest. Obtained around Mangpu at an elevation of 3,600′, (G.E. Shaw.) and at Turzum, 5,200′, 17-4-21, (O. Lindgren). Gopaldhara, 4,720′, 21-5-23* seen to take a spider out of a bed of Nicotiana flowers and demolish it on the ground.

357. The Sikkim Yellow-vented Flower-pecker. Dicæum chrysorrhœum intensum Stuart Baker.

A Plains-Flower-pecker obtained at elevations of 500′ at Golar Ghat, Mahanuddi River, ♂ 29-12-20, up to 2,500′, ♂ 23-2-21 in the Tista Valley. (G.E. Shaw).

358. The Fire-breasted Flower-pecker. Dicæum ignipectum (Hodgs.).

Generally distributed from 3,500-10,000′. Only recorded up to 7,000′ for the Himalayas. Partial to forest; during "the cold weather" it may be found in sparsely wooded tracts. Commonly occurs around Gopaldhara, 3,500′, ♂ 31-1-19; 5,000′, ♀ ♀ 5-1-12; ♂ 19-1-19; 4,900′, ♀ 21-12-19, obtained amongst the tangled growth of a lofty tree. 5,500′, ♂ 21-12-19, shot whilst pecking away at the berries of a forest-tree,—name unknown. 5,800′, ♀ 17-2-18; 5,000′, ♀ 2-3-18.; ♂ 16-3-16. 6,000′, ♂ 10-3-18. In March 1919, females were much more in evidence than males; all were gaily chattering from the topmost branches in an incessant volume of song for such a small bird. Equally plentiful at elevations of 4,600′-4,800′ around Singhik on the 23-2—12-3-20.

359. The Plain-coloured Flower-pecker. Dicæum minullum olivaceum Wald.

In all probability occurs at the *base of the hills in the Terai*. Easily overlooked. Found in fair numbers in the densely forested area at the foot of the hills of Bhotan on the Raidak River in the Eastern Dooars, at the end of January 1922. Very noisy as they poured out their lively trill from the tops of the lofty trees. Specimens collected 25-1-22, showed the birds to be about to nest.

Soft parts: Iris brown; bill plumbeous-grey, upper mandible and tip of lower mandible blackish-plumbeous; tarsus plumbeous horny; soles grey. *Dicæum cruentatum cruentatum* (*L.*) is only likely to be found at *plains-levels.*

360. The Thick-billed Flower-pecker. Piprisoma squalidum squalidum. Burton.

Recorded for the "Himalayas at low elevations from the Sutlej Valley to Sikkim." I have seen no specimens collected nearer to these hills than Tirhut in Behar. C.M. Inglis.

361. The Yellow-bellied Flower-pecker. Pachyglossa melanoxantha. Hodgs.

Evidently rare and extremely local. Obtained near Sonada at 6,500′, ♂ in May 1920 and ♂ 27-3-21. I am under the impression several scattered males, the females possibly overlooked, came under my observation in December 1911, when working the Semana-Mirik Ridge above Gopaldhara at an elevation of from 5,500′-6,000′. At the time I took them for *Chalcoparia singalensis,* a bird which could not possibly occur hereabouts; as no specimens were secured this record lacks substantiation. Mr. G.E. Shaw's specimens are the only ones I have seen.

362. The Ruby-cheek. Chalcoparia singalensis singalensis (Gmel.).

This species is gregarious in the cold-season when it occurs at this period in parties. Obtained at Bhotan Ghat on the Raidak River Eastern Dooars, in January 1922, ♂ ♀ 22-1-22. There was quite a crunching noise audible, caused by this small party of birds, out of which one pair was secured, as they *probed vigorously with their bills,* sometimes *hanging on with their feet to the dry leaves* reminding me more of *the actions of White-eyes without their delicate movements.*

Soft parts: Iris red-brown; bill black; tarsus yellowish-plumbeous, soles similar.

363. The Blue-naped Pitta. Pitta nipalensis nipalensis (Hodgs.).

Occurs sparingly around Gopaldhara upto 5,000′ or thereabouts, and up to 3,700′ at all events at Mangpu, (G. E. Shaw), at this same locality Gammie obtained it breeding twice at 5,000′ in June.

♂ Juvenile, 16-6-16, agrees with Oates's description in so far as that goes. Forehead to nape, feathers centred with pink, shading into pale ochreous, giving it a streaky appearance; upper portion of orbital ring fulvous; upper plumage black with broad fulvous spots, very prominent on the wing-coverts; primary-coverts black; wing and tail ochreous-green, the tips of the tail with ochreous centres; chin and throat, pink merging into fulvous and black of the posterior and upper portions of the ear-coverts and sharply defined from the black,fulvous-tipped feathers of the breast; belly, entirely pink with faint dusky edges; under tail-coverts with broad-white tips, tinged with ochreous and pink.

Soft parts: Juvenile. Iris hazel-brown; bill orange lobster-red; upper mandible dusky in centre; tarsus pale dusky lobster-red.

364. The Indian Pitta. Pitta brachyura (L.).

I have observed this beautiful Pitta on one occasion 11-6-19* only, at a *low elevation* in the Great Rangit Valley. The B. M. Coll. also contains a single specimen collected by Mandelli from the Lower Hills in April 1874. The nearest locality where it commonly occurs is Behar and it is well represented by Hodgson's specimens in the National Collection.

365. The Green-breasted Pitta Pitta cucullata cucullata. Hartl.

Probably *confined to the Terai and Foot-hills only,* in a similar lay of land and heavy forest to that, in which it occurred on the North frontier of Assam. Jerdon records obtaining one specimen breeding at 1,200′ in the Gt. Rangit Valley. There are numerous specimens of this species from the lower hills in the B. M. Collection.

366. Hodgson's Broadbill. Serilophus lunatus rubropygius (Hodgs.).

Recorded for the "Himalayas below about 5,000′." Evidently *does not occur much beyond the plains-level* as I have nothing to record in support of this statement excepting negative evidence. Gammie is mentioned by Hume, as having obtained it breeding at Mangpus around an elevation of 3,000′ on one occasion. Mr. G. E. Shaw has so far not obtained it from this same locality so it appears to be confined to lower limits generally.

H. S. Photo.

ABOVE KARPONANG. March, 1917.

Haunts of *Conostoma æmodius*, *Suthora fulvifrons*, *Pteruthius xanthochloris*, *Läiscopus himalayanus*, *Carpodacus thura*, *Lophophorus impejanus*, *Ithagenes cruentus*, &c., &c.

H. S. Photo.

LACHUNG VALLEY ABOVE KEDOM.

Looking north. 11th March, 1920.

A *Palæarctic Avi-fauna* below the region of the Pines. *Suthora unicolor*, *Aegithaliscus iouschistos*, *Yuhina occipitalis*, *Proparus chrysotis*, &c., &c., in the valley-bottom.

367. The Long-tailed Broadbill. Psarisomus dalhousiæ (Jameson).

This beautiful Broadbill is generally distributed up to *an elevation of 5,000′* in the Rungbong Valley; it appears only sporadically, and these movements are difficult to follow. Recorded up to 6,000′. Gopaldhara, 4,720′, 13-1-18,* calling adjacent to the bungalow and heard for some time previously, again on the 28-3-15.* 5,000′ upwards, calling in the forest, 22-4-16* and also heard at a similar elevation 14-20-5-15. Sepoydoorah to Tindharia, 2,500′, 13-3-14,* much in evidence. Gammie obtained it breeding at 2,500′ in April in the Tista Valley.

368. The Assam Black-naped Green Woodpecker. Picus canus gyldenstolpei Stuart Baker. " Larchi Paharis.

Used without distinction for all Woodpeckers.

In the vicinity of Gopaldhara occurs up to an elevation of 5,500′ or somewhat higher. Found in open, sparcely forested tracts, as well as the defined forested areas.

The young ♂ (Assam) 7-8-04, has the crown merely tipped with fulvous, and with the exception of the head, the whole of the upper and lower plumage, especially the upper tail-coverts and tail are in moult; in this last condition resembles an adult ♂ 31-7-04.

369. The Small Himalayan Yellow-naped Woodpecker. Picus chlorophus chlorophus. Vieill.

Commonly occurs at plains levels. In the Rungbong Valley is found up to an elevation of 5,000′ at all events. Recorded upto about 10,000′. I have nothing to mention in support of this statement. Nine examined: Some females show a tendency to resemble the male in having a "few" feathers of the forehead over the black stripe and in front of the eye coloured red.

370. The Large Yellow-naped Woodpecker. Chrysophlegma flavinucha flavinucha (Gould).

Recorded for the Himalayas chiefly between 2,000′ and 7,000′. I have noted this Woodpecker at all elevations from 600′ upto 5,500,′ and it possibly exceeds these limits to some slight extent. Whilst it occurs commonly at plains-levels, the recorded limit is likely to be rarely reached.

371. The Northern Pale-headed Woodpecker. Gecinulus grantia grantia McClell.

Recorded chiefly between 2,000′ and 5.000′. Evidently locally distributed. Occurs in the Tista Valley, and obtained below Mangpu at 3,500′. (G. E. Shaw). My only information respecting this Woodpecker was obtained in the Plains of Upper Assam.

372. Rufous-bellied Red Woodpecker. Dryobates hyperythrus hyperythrus (Vig.).

Occurs along the Singile La Ridge from Tonglo to Phalut at 10,000′—12,000′ during June to August. In the winter it is decidedly rare at these high elevations. I cannot follow Blanford's statement: "the commonest Woodpecker in the pine forests of Sikkim at 9,000′-12,000′" which would very aptly apply to *D. darjellensis*, and as I note the Lepcha name is given for the latter and not for *D. hyperythrus* I surmise the letterpress has been somehow transposed.

Three examined: Tonglo, 9,000′, East Nepal, ♂ 3-2-12. Nepal-Sikkim Frontier, ♂ 30-6-04. (C. M. Inglis). Phalut, 11,600′, ♂ 9-8-05. (C. M. Inglis). The two last specimens evidently obtained in the Pine forests. I am wrong in my surmise but allow the original note to stand and quote Blanford's remarks "The change from the fauna of outer Sikkim where Woodpeckers abound as they do throughout Malayasia, is strikingly exemplified by this family. It is doubtful if *P. hyperythrus* has been obtained in the neighbourhood of Darjeeling; specimens reported to have been brought thence were probably shot in the interior." He speaks of it as rare in the Pine forests where two specimens were obtained at 9,000′, Lachen and 10,000′, Lachung. It has of course, *a decided Palœarctic status.*

373. The Darjeeling Pied Woodpecker. Dryobates darjellensis (Blyth).

Recorded for the Himalayas in Nepal and Sikkim from about 3,000′-12,000′ elevation. This distribution is totally incorrect, although it has been obtained below the Sonada to Kurseong Ridge at *6,000′*; this elevation may well be considered the extreme, lowest limit, as it does *not appear to be found much below 8,000′ in winter.* Obtained on Tonglo at 10,000′, 10-2-12. Commonly occurred around Kalo Pokhari during April 1912, at a similar elevation. Obtained south of Lachung at 8,600′, 26-2-20. Observed at close quarters south of Senchal at 8,200′, ♂ 24-3-15*. Obtained above Mangpu at 6,000′. (G. E. Shaw). Mai "Khola", East Nepal. Several clutches of two and three eggs. 28×20 average, taken in April and May at elevations of from over 8,000′-10,000′. Ten specimens examined.

♂ Wing 126-129, av. 127·3. ♀ wing 123-127, av. 124·4.

There is some individual variation in the depth of tone and in the intensity of the black streaks on the underside in adults.

Two immature ♂ ♂ obtained on Tonglo at 10,000′, 6-7-04, (C. M. Inglis.), and between Dentam and Chiabanjan 7-8-05, have the whole crown tipped with crimson-red and orange-red respectively; this coloration is evidently a distinct, characteristic phase of the immature male and substantiates Scully's description to which Blanford merely makes passing mention. Wing in both examples 122.

374. The Lesser Pied Woodpecker. Dryobates cathpharius cathpharius (Blyth).

Recorded with a range similar to *D. darjellensis* (Blanford). I have failed to meet with this Woodpecker at such high elevations as the former. The zonal distribution of this species is mainly between *5,000′-6,000′*, and though these limits are exceeded in both directions, there is only a remote chance of meeting with it at 3,000′. Occurs in the Rungbong Valley from 4,500′-7,000′ and also occurs in East Nepal at similar elevations; 7,000′, ♀ 22-5-12. Obtained around Mangpu from 5,600′-6,000′, (G. E. Shaw). Observed near Kedom at 7,000′, in March in the Lachung Valley and at Mangam below Ringim Gompa at 4,300′, in February, in the interior of Sikkim. Even in the winter, I have always found *D. darjellensis* above the highest limit of *D. cathpharius.*

Eight specimens examined:

♂ Wing 99-102, av. 100·5; ♂ juv. wing 95. ♀ wing 96-101, av. 98·6.

Soft parts: Iris red-brown; bill plumbeous-horny; tarsus "greenish"—plumbeous, claws, similar only horny.

375. The Fulvous-breasted Pied Woodpecker. Dryobates macei macei (Vieill.).

Occurs in the Rungbong Valley up to an elevation of about 3,500′, and is found chiefly in the bottom of the valley and not in the thick forest which is above the limit of its range; so far it has not been obtained above 2,400′ in the Tista Valley (G. E. Shaw), where it might be expected to reach a higher limit than in the minor valleys to the west.

There appears to be *well-defined limits in the distribution of each of the members of this genus,* particularly where competitive forms have to maintain their status in a limited forested area, as is the case where cultivation has altered the face of the country through depletion of the forests.

Three specimens examined: Rungbong Valley, Darjeeling, (December) ♂ wing 108; ♀ ♀ wing 105-109, av. 107, compared with five Assam skins, ♂ ♂ wing 102·5-104, av. 103·3; ♀ wing 103. This disparity in size is significant and almost points to the formation of a race, distinct from the plains bird.

376. The Darjeeling Pigmy Woodpecker. Iyngipicus semicoronatus (Malh).

Recorded for Sikkim at elevations above about 3,500′.

Occurs in the Rungbong Valley at elevations of from about 3,400′-4,500′. In the Tista Valley occurs as low as 1,100′ to 3,800′, (G. E. Shaw). Observed and obtained in pairs, four to five miles out from the Hills in *the plains* of the Eastern Dooars, between Jainti and Hathipotha and on the Raidak River in January 1922. Found in light, tree-growth outside the limits of the heavy forest. Gopaldhara, 3,500′, 10-5-20. Three to four, or probably, two to three males and an odd female, the males vieing with each other for the possession of the female, they were so mixed up in their movements, I failed to count the exact number and the preponderant sex.

Five examined: ♂ Wing 83-88 av. 85·7; ♀ wing 84-87, av. 85·5.

377. The Red-eared Bay Woodpecker. Blythipicus pyrrhotis pyrrhotis (Hodgs.).

Confined strictly to close forest with heavy undergrowth. Occurs around Gopaldhara at from 4,700′ to higher limits on the Nepal Frontier at 7,000′ or even appreciable higher in the Mai "Khola". This Woodpecker feeds in a great measure on the ground in such dense cover as seems more in keeping with the habitat of some of the Laughing-Thrushes. Seven specimens examined:

♂ Bill from feathers 47-48, av. 47·5; wing 145-148, av. 146·5.

♀ At base 45-48, av. 45·6; wing 146-149, av. 147·4.

All my Sikkim skins have the tail barred throughout; in a single example from Assam, this character is only faintly indicated, the centre pair being uniform rufous.

378. The Northern Rufous Woodpecker. Micropternus brachyurus phaioceps Blyth.

Gammie mentions this species as breeding at 2,000′ in the Tista Valley.

Obtained around Mangpu at 3,800′ (G. E. Shaw).

Absent at much lower elevations in the west of the Darjeeling district. I have failed to meet with it anywhere in the Rungbong Valley at its lowest limits.

379. The Himalayan Golden-backed Three-toed Woodpecker Tiga shorei (Vig.).

Recorded for the lower valleys of the Himalayas as far to the east as Bhotan. So far I have failed to locate it, and it is only likely to be found along the *Terai of the foot-hills.*

380. Tickell's Golden-backed Woodpecker. Chrysocolaptes gutticristatus gutticristatus (Tick.).

Confined to low elevations, probably not occurring much above 2,000′.

381. Hesse's Great Slaty Woodpecker. Alophonerpes pulverulentus harterti (Hesse).

Evidently does not occur higher than the Terai, as it is only likely to be found in heavy, forested tracts.

382. The Himalayan Speculed Piculet. Picumnus innominatus innominatus Burton.

Recorded up to 6,000′ and even ascending to 9,000′ (Stolickza); which latter extreme height evidently refers to a locality in the North-West Himalayas. Apparently *does not occur at a higher elevation than 4,500′ or thereabouts.* 4,700: (G. E. Shaw.), both in the interior of Sikkim and on the Outer Ranges. Occurs sparingly around Gopaldhara; noted at Singhik, 4,600′, and is generally distributed.

383. The Indian Rufous Piculet. Sasia ochracea ochracea Hodgs.

Occurs around Gopaldhara up to an elevation of 6,000′ at all events, and plentifully distributed throughout the whole area, both in the valleys and on the ridges. My observations place this Piculet with a *somewhat higher distribution* than *P. innominatus.* Observed commonly between Singhik and Dikchu in March, around an elevation of 3,500′. Gammie mentions this Piculet as breeding at 4,000′ in the Tista Valley, which locality probably refers to Mangpu.

384. The Japanese Wryneck. Jynx torquilla japonica Bp.

Represented in the National Collection by one specimen from Sikkim, January 1873. Evidently only occurs rarely at moderate elevations during " the cold weather "; as there is certainly no well-marked migration route through Sikkim as was obvious in Upper Assam, when it commonly occurred on its descent to the plains and at its time of departure. The few birds occurring on migration, may of course, pass over unnoticed without breaking their journey, though it seems hardly feasible. It is certainly remarkable that only a single occurrence has come to my notice during a period of ten years, when one was secured at 4,200′ in December 1911, below Gopaldhara; on the ground as on every former occasion. As this form has a wide distribution, I have considered it expedient to examine my Assam material. Nine specimens measure:

♂ Wing 82·5-86, av. 84·5; ♀ wing 80-85, av. 82·3.
♂ Bill from base, 15-19, av., 16·8; ♀ 15·5-17, av., 16·2.

Dr. Hartert gives the wing measurement, Ussuri, 80-86; Japan, 80-85; China, 80-86, thus the size of this Eastern form is fairly constant and Assam cold-weather migrants show similar measurements.

385. The Yellow-backed Honey-Guide. Indicator xanthonotus Blyth.

Recorded for Sikkim, " very rare " which is undoubtedly the case. Represented in the Tring Museum by one specimen ex. Elwes Collection, and in the British Museum from Native Sikkim as follows : ♂ October, ♀ December 1878, 2 ♂ ♂ February 1879, ♀ March 1874, ♂ April 1879. I have not been fortunate to meet with it. Evidently resident somewhere in the interior.

386. The Great Himalayan Barbet. Megalæma virens marshallorum Swinh. "Newal" Paharia.

Recorded for the Himalayas between 3,000′ and 8,000′. Breeds commonly above Gopaldhara up to 6,500′ at all events, and observed in the interior of Sikkim at Dikchu at 2,150′ in February and March. Also heard calling in the foot-hills of the Bhotan Dooars near the Raidak Gorge in January; none however were actually seen at plains-levels. Gopaldhara, 4,720′, 15-7-14 ; a party daily frequent the pear trees in the compound. 20-6-23, youngster brought in almost ready for flight, safely hand-reared to maturity.

The monotonous, wailing call of this Barbet is one of the most noticeable characteristics of the birds hereabouts.

387. The Assam Lineated Barbet. Thereiceryx lineatus hodgsoni (Bonap.).

Recorded for the Lower Himalayas, not ascending more than 2,000′ or 3,000′. These limits are too great an extreme for Sikkim. This Barbet appears to be *confined to its distribution area by the belt of heavy forest at the base of the hills.* I found it to be common in the sparsely wooded country, four to five miles away from the hills in the Eastern Dooars.

388. The Blue-throated Barbet. Cyanops asiaticus asiaticus (Lath.).

Recorded for the Lower Himalayas up to 3,500′ or 4,000′.

In the Rungbong Valley occurs up to 4,500′, and observed on one occasion at 5,200′, 26-12-21; also obtained up to an elevation of 6,000′, above Mangpu. (G.E. Shaw).

389. The Indian Blue-eared Barbet. Cyanops duvauceli cyanotis (Blyth).

Recorded for Sikkim. I have seen specimens from the Terai where it is probably far from common. It appears to be strictly *confined to the base of the hills* in the Eastern Himalayas.

390. The Golden-throated Barbet. Cyanops franklini franklini (Blyth).

This Barbet commonly occurs in the Rungbong Valley from 4,500′ up to 7,000′, and may on occasions considerably exceed the higher limit. Whilst it is found as low as 3,500′ in the interior of Sikkim; it appears not to be found below 4,500′ in the hills to the west of the Tista Valley as there is practically *no overlapping with C. asiatica in any areas of its distribution* though both species meet; apart from some dispersal which causes a slight perceptible intermingling during the winter, when food is none too plentiful. This movement does not affect the distinct breeding areas of either species.

Gopaldhara, 5,000′, 11-9-21. Two youngsters about to leave the nest; evidently this Barbet is double-brooded, judging by this late date.

The young bird has the head golden-green; forehead crimson and patch on occiput faintly tinged with crimson; ear-coverts shading into bluish-green throat and spot at base of lower mandible pale yellow; primary-coverts on carpus bluish-green; otherwise the general coloration is as well defined as in the adult. Taken young, these birds make charming pets, readily taking food out of one's hand ande larning to recognise their master's voice and step. Tonglo, 10,000′, 5-2-12.* I saw an unmistakable Barbet which could only have been this bird. although no Barbets were calling at this high elevation in January and February.

391. The Northern Indian Roller. Coracias benghalensis benghalensis (L.).

Occurs at *plains-levels only*; observed at Rungpo, on the maidan, in the Tista Valley in Sikkim (March).

392. The Indian Broad-billed Roller. Eurystomus orientalis orientalis (L.)

Recorded for the base of the Himalayas up to 3,000′. Another *plains and low elevation* Roller; obtained up to an elevation of 2,000′ in the Tista Valley

(G. E. Shaw.), and reported to me as having actually been seen on the Chowrasta in the Station of Darjeeling by the late Mr. E. A. Wernicke.

393. The Common Indian Bee-eater. Merops orientalis orientalis Lath.

Commonly occurs at the *plains-level,* where it has been obtained in the south of the Darjeeling District at 500′, (G. E. Shaw). I noted it as being plentiful in the open country in the Eastern Dooars in January.

394. The Chestnut-headed Bee-eater. Melittophagus erythrocephalus erythrocephalus (Gmel.).

This Bee-eater has been obtained at the *foot of the hills* (G. E. Shaw).

395. The Blue-bearded Bee-eater. Nyctiornis athertoni (Jard. & Selby).

Observed in the Rungbong Valley at an elevation of 3,500′ in December 1911, and obtained up to an elevation of 1,800′ on the 1-9-20, in the Tista Valley, (G. E. Shaw). Recorded distribution up to about 4,000′. There is only a remote chance of meeting with it, except on rare occasions as above mentioned; as it appears to be strictly *confined to the base of the Lower Foot-hills and Plains.*

396. The Himalayan Pied Kingfisher. Ceryle lugubris guttulata Stejn.

Wherever this fine Kingfisher can get a sustenance , it is to be found on every river of consequence. In the Rungbong River, an odd pair or two reach the upper limits at an elevation approaching 4,750′. I have no information as to how far it penetrates into the interior by way of the Tista River ; it has, however, been obtained on the " jhoras " in the lower portion of the valley up to an elevation of 1,200′. (G. E. Shaw).

397. The Common Indian Kingfisher. Alcedo atthis bengalensis Gmel.

Occurs in the Tista river and all tributaries where it has been obtained up to 1,900′, (G. E. Shaw). On the Rungbong River it ascends as far as there is a sufficiency of water, but as the river gets depleted in " the cold weather" from December to March, it is found more noticeably to frequent the lower reaches from 3,500′ downwards.

398. Blyth's Kingfisher. Alcedo iredalei Stuart Baker.

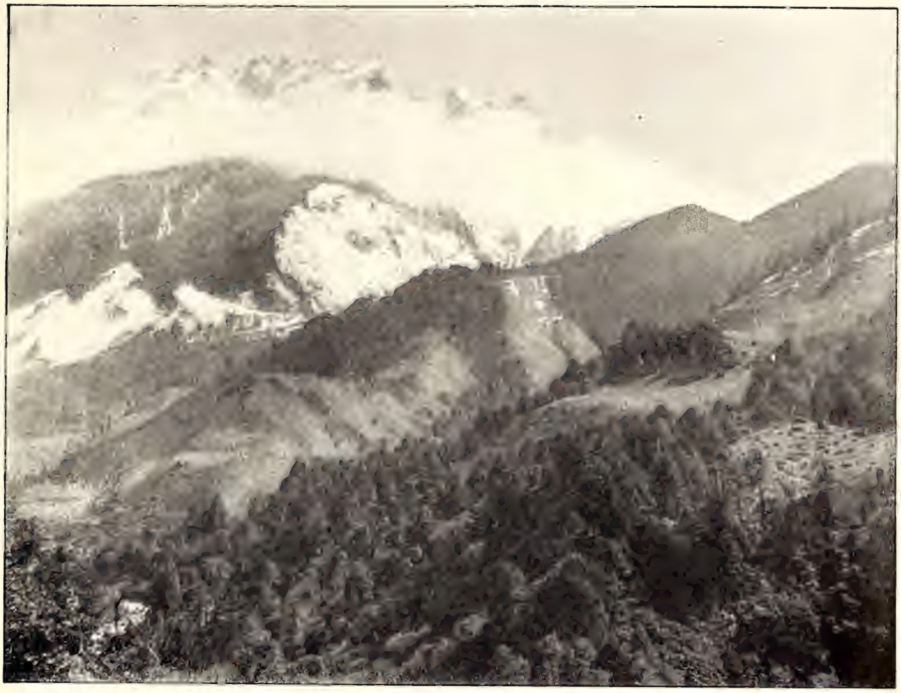
Recorded for the *Lower Foot-hills* of Sikkim.

399. The Indian Three-toed Kingfisher. Ceyx tridactylus tridactylus (Pall.).

Obtained on one occasion at Mangpu 3,600′, 6-9-13. (G. E. Shaw). This beautiful miniature Kingfisher seems addicted to wandering away from its accustomed haunts during "the rains" as was frequently noted in Assam, which accounts for it turning up in the most unexpected places.

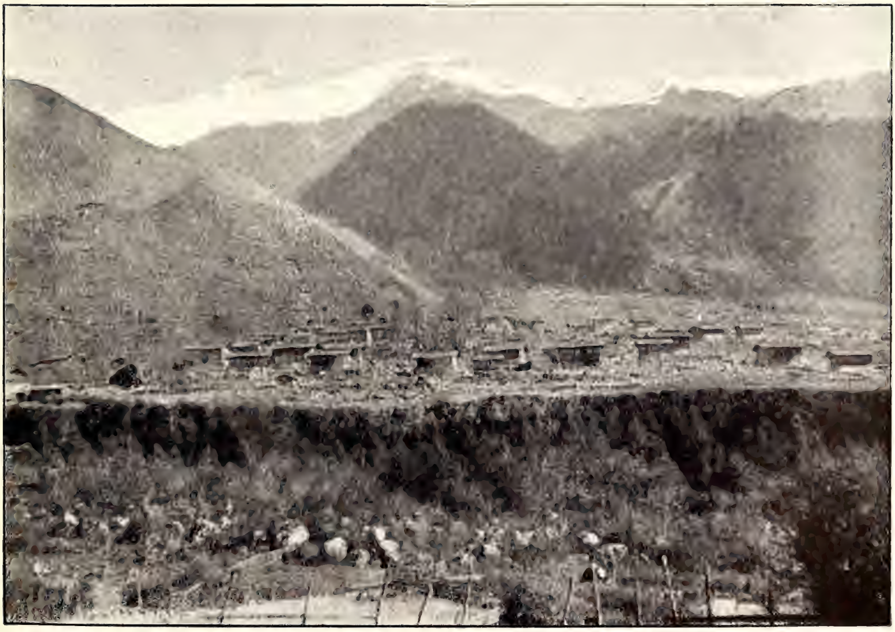
400. The Brown-headed Stork-billed Kingfisher. Ramphalcyon capensis gurial (Pearson).

I always regarded this Kingfisher as being strictly confined to the " Jhils " and sluggish streams of the Plains, until one was obtained adjacent to the Rungbong River during a dry spell of weather at 3,400′ on the 27-4-17, ♀; this specimen is altogether paler than any of my Assam skins : the point of the bill is much worn as a result of securing its food in the shallow water and stony bed



H. S. Photo.

LACHUNG VALLEY.
Looking north-east, elevation 9,000′. 11th March, 1920.



H. S. Photo.

LACHUNG VILLAGE, elevation 8,800′.
10th March, 1920.

of the river. Observed flying up stream on the 29-11-18,* at an elevation of 3,750′, and since this date I have seen it on several occasions over long periods though these occurrences have not been duly jotted down. It may ascend some the other swift-flowing, minor rivers of the foot-hills in a similar manner.

401. The Indian Ruddy Kingfisher. Entomothera coromanda coromanda (Lath.).

Recorded for the Lower Himalayas up to about 5,000′ for Sikkim.

No evidence has come to my knowledge in substantiation of its claim. As it is a rare bird generally and as there is a strong likelihood of it occurring at the foot of the hills "in forest" and being easily overlooked; it is worthy of inclusion on the recorded statement.

402. The Great Hornbill. Dichoceros bicornis (L.). "Kodong" Lepcha.

This exceptionally grand bird, attached to which there is so much interest in regard to its habits and in particular its nidification, may be regarded as the representative of the remarkable family of Hornbills; the different genera of which are worthy of more than casual notice.

Evidently sparingly distributed throughout the Tista Valley up to an elevation of 4,500′ at all events. More generally confined from the base up to a limit of 2,000′-3,000′ in the foot-hills. As it is only to be found in heavy forest; there can be little doubt that it formerly covered a wider tract of country but extensive cultivation, and improvident and disastrous methods in clearing the land have resulted more often than not in producing nothing more than a barren waste in place of magnificent forest. Nurbong, 2,500′, 14-3-14,* a party of four birds seen to settle in the almost inaccessible forest on the left bank of the Mahanuddi. Heard calling on rare occasions in the Balasan Valley, some miles above Panighata.

Hathipota, Eastern Dooars, 6-1-22,* I was gratified to come upon a party of six to eight birds in occupation of some lofty trees in virgin forest, but judging by the systematic harassing, amounting almost to persecution, by hoards of Paroquets (*Psittacula a fasciata*), there was little chance of ever obtaining that desired peace and quietness which the Hornbills stood sadly in need of.

There is every reason to suspect that a similar state of affairs exists towards the breeding season, as these pests will do their utmost to appropriate every nesting cavity, whether in occupation by the rightful owners or not. When competition for the right of survival becomes more acutes through the depletion of the forested tracts; the status of all our Hornbills is certain to be detrimentally affected. Opinions may differ as to the correct methods to adopt in this difficult question of giving protection to one species at the expenses of another. A drastic thinning-out of such Paroquets, as haunted the vicinity of their breeding haunts, would have a beneficial effect, and would seem to be the only feasible and correct course of action to ensure the hornbills them the necessary protection. As the broad facts of the preservation of our wonderful and rich avi-fauna unfortunately concern only a limited few, and are not rightly understood; it is premature to expect any efforts to be centred on special cases calling for protection, therefore meanwhile it would be advisible to confine all attention to the reservation of sanctuaries, and endeavour to create a healthy public interest in this direction.

403. The Large Indian Pied Hornbill. Anthracoceros. coronatus affinis (Blyth).

Recorded for the Lower Himalayas.

404. The Rufous-necked Hornbill. Aceros nipalensis (Hodgs.). "Kolep" Lepcha.

Recorded for the Himalayas of Nepal, Sikkim and farther east from 2,000′ to about 6,000′. My first acquaintance with this Hornbill was noted as follows:

Nurbong, 1,800′, 10-3-14.* A large dark coloured Hornbill; bill, white, no perceptible casque ; tips of wings white, and a heavy patch similarly coloured at end of the tail, uttering a call somewhat resembling the syllables "ghwa" "ghawa."

Since this occasion I have seen a few obtained in the Tista Valley. Formerly Hornbills used to ascend to the upper limits of the Rungbong Valley in the recollection of the oldest residents, but have long since disappeared when their favourite trees had been felled. In the event of such an occurrence happening nowadays, I should almost doubt my powers of vision at such a surprise. In Hume's "Nests and Eggs of Indian Birds" (Oates) Vol. III, p.77, is an interesting and long account by Gammie of the nidification of this species in May at Poomong. Reported to me as having been seen above Gopaldhara in March 1922, when a nest was found this year in Nepal. Obtained also in 1922 above Rungmook, in pairs on both occasions.

405. **The Tibetan Hoopœ. Upupa epops saturatus.** Lonnb.

This Hoopoe is a common and familiar bird during the winter in the Plains and occurs at *moderate elevations on migration.* Gopaldhara, 4,720′. Odd Hoopoes make a brief sojourn almost yearly, on their descent to the plains: whilst the majority evidently pass over on migration. During the time they remain, are remarkably tame and as one or two invariably frequent the compound their arrival is always looked forward to with interest.

Earliest arrivals—7-9-17,* 11-9-17,* 26-9-18,* 19-9-20,* 2-10-21.*

All these records refer to the bungalow elevation of 4,720′, and to single birds. 3,500′, 28-9-21,* single bird. Mr. G.E. Shaw has seen it on migration at 5,300′, and at 8,000′. The earliest arrival noted at Mangpu, 3,860′, being on the 3-10-15, ♀.

Latest departures, 30-3-18,* Nagri, 4,500′. 17-3-20, above Turzum, 5,650′.

406. **The Indian Hoopoe. Upupa epops orientalis** Stuart Baker.

If I rightly understand the nomenclature and distribution of the forms of the resident, plains Hoopoe was previously denoted under *U. epops indica* I take it the Hoopoes observed on the following dates at Gopaldhara on the 22-8-18* and 30-9-19* refer to this race, as these were probably the resident, plains species ; some slight doubt exists as to the former record, whilst the latter record undoubtedly has reference to a richly coloured bird. As no resident Hoopoe occurs in the Rungbong Valley, these occurrences denote a partial migratory movement before the termination of "the rains".

During the Mount Everest Expedition, Mr. A.F.R. Wollaston saw this Hoopoe several times flying over a glacier at an altitude of about 21,000′ in September and Mr. N.B. Kinnear remarks on this extraordinary altitude for a bird of such weak flight. For a list of the birds found at these extreme altitudes, consult his paper to which reference is made under other species. Kinnear refers these Hoopoes to "*orientalis*" and not "*saturatus.*"

407. **The Alpine Swift. Micropus melba melba** (L.).

Recorded for Darjiling, though apparently there are no specimens in the B.M. Coll. from the Sikkim Himalaya. It is well represented by a fine series from Simla, so it evidently has a clearer defined status in the North-West Himalayas.

408. **The Common Indian Swift. Micropus affinis affinis** (Gray).

Recorded as ascending the Himalayas up to about 6,000′.

This Swift, wherever stablished in the verandahs of dwelling-houses, invariably usurps the bulky mud structure of the Swallow (*Hirundo daurica nipalensis*), and having once obtained possession, its occupancy becomes a permanency. At Gopaldhara, one such nest has been occupied for ten years; the birds remaining the whole year round. There is little doubt, they cover enormous distances when climatic conditions are not favourable; and when the whole surrounding hills are enveloped in mist, it is nothing short of miraculous how readily they locate their quarters and dash in with arrowy flight. I noted these Swifts to have young on the 6-5-15; and young birds, to leave the nest on the 31-5-16*: a brood of the following year. They are absent for the whole day during the cold-weather months, and at Nurbong 2,050′, observations extending over a period of eight days from the 19—26-1-14. I noted the pairs arrived between 4-50 p.m. and 5-30 p.m. at the nests almost simultaneously, having been absent the whole day. Okayti, 7-6-23. I counted thirty-eight nests, comprising a colony, when every available site appeared to be occupied under the eaves of an office outbuilding.

Obtained in the Mai "Khola", East Nepal, ♂ ♀ 23-5-12.

409. The White-necked Spine-tail. Hirundapus caudacuta nudipes. (Hodgs.).

Recorded as throughout the Himalayas. Specimens in the B. M. Coll. from Sikkim are dated March, April, May (Mandelli.), one from Nepal (Hodgson.), and one from Bhotan (Pemberton). I have observed it on very few occasions; once above Okayti at 5,600′ approximately,* probably in May, when there was a party taking their food without any appreciable effort during a bright morning and at the Turzum factory when a pair were seen at an elevation of 4,900′ approximately, 24-6-21*; on this occasion they showed their wing power to the best advantage, when climatic conditions were not so congenial as on the previous occasion. Often observed at Gopaldhara at the oncoming of a storm half-a-dozen birds seen on the 28th April in company with several Swallows and again 31-5-23, on this occasion exclusively.

410. The White-rumped Spine-tail. Idacapus sylvatica (Tick.).

Recorded for Sikkim. Not represented in the National Collection by any Sikkim specimens.

411. The Hymalayan Swiftlet. Collocalia pusciphaga brevirostris (Mc Clell.).

Occurs at *all elevations up to 12,000′*, but its appearances are very erratic. Several observed on the Singile La Ridge near Phalut at 11,700′ on the 19-2-12, a ♂ secured out of a number at evening, a Kalo Pokhari at 10,160′ on the 22-5-12. Numbers observed hawking for food around the Gopaldhara Bw. at 4,720′ on the 15-8-15*. Obtained in the Tista Valley at 3,600′, ♂ 2-9-20. (G. E. Shaw). Blanford also records it from the Cho La at 12,000′ (August) and throughout the Tista Valley at low elevations in the autumn of 1870.

Hume records finding the Indian Crested Swift *Macropteryx coronatus* (Tick.) breeding in May in the Darjeeling Terai.

412. The Nepal Long-tailed Nightjar Caprimulgus macrurus nipalensis Hartert.

This Nightjar is more a bird of the Plains than the Hills, and I have failed to locate it in the valleys to the west. Obtained at elevations of from 2,500′-3,760′ in the Tista Valley. (G. E. Shaw). I have gone through all my Assam skins.

Nine examined: Juvenile, ♀ (June) wing 193 ; ♂ (July) wing 200, probably not quite fully grown. Adult ♂ wing 204-219, av. 210·8. Adult ♀ wing, 211-219, av., 214·3.

These specimens are very variable in the depth of tone and the barring on the underside.

413. The Himalayan Jungle Nightjar. Caprimulgus indicus jotaka. (Temm. & Schleg.)

Occurs up to 7,000′-8,000′ during the breeding season and found at all intermediate heights from the base of the hills in "the cold weather." Gopaldhara, 3,500′, 31-10-14, several in evidence. 3 ♂ ♂ 23-12-11. Mai Khola, East Nepal, ♀ 22-5-12, wing 200 ; obtained with two eggs which measured 30×19, av.

Five males examined : 3 ♂ ♂ Sikkim, wing 203-206 ; av. 205·7.
Bhotan Dooars, 27-1-22, ♂ wing 193. Assam, 12-2-05, ♂ wing 199.
Dr. Hartert gives the wing measurement for "*indicus*" 197-203, and for "*jotaka*" type, locality Japan, ♂ 212-224.
In size my specimens are nearer the typical form.

414. Gould's Great-eared Nightjar. Lyncornis cerviniceps cerviniceps Gould.

Included on the recorded specimen said by Jerdon to have been obtained in the Tista Valley.

415. Hodgson's Frogmouth. Batrachostomus hodgsoni (G. R. Gray).

Recorded for Sikkim at *low elevations.* Great Ranjit Valley, 3,000′ and 4,000′ (Hodgson), Namchi (Mandelli). Evidently as rare as it was in the Foot-hills of Assam.

416. The Red-headed Trogon. Pyrotrogon erythrocephalus erythrocephalus (Gould).

Recorded for the Himalayas up to *5,000′ at which elevation it occurs* at Gopaldhara,and as it is strictly a forest species it would appear to be isolated hereabouts at the upper limit of its range from its main distribution area, as for instance at Gopaldhara where to the south the country is under cultivation until the forest reserve is reached at about 2,000′, with the exception of sparsely wooded areas intervening.

417. The Asiatic Cuckoo. Cuculus canorus telephonus Heine.

With the commencement of the hot weather, it is possible to trace the ascent of the Cuckoo, as the birds commence calling almost immediately, when they enter the valleys, and announce their arrival according to the distance and elevation reached. Its appearances around Gopaldhara take place with marked regularity; and invariably occur during the latter days of March or the first week in April. Its arrival has been noted over a number of years. Gopaldhara, around 4,720′. First heard calling on the 1-4-14, and noted again on the 12th to be calling up to 6 p.m. The last occasion when I heard the familiar call being on the 11-7-14. The following year on the 31-3-15. Noted to be calling a few times at 6-30 a.m., on the 6-5-15. Calling somewhat inaudibly on the 23-3-16 ; its full note heard on the 27-3-16, and remarked as silent during July 1917 prior to the 21st; when it was heard to call, 31-3-17, heard again on the 2-4-17, and almost daily afterwards when the air resounded with each male bird endeavouring to outdo his neighbour. Heard above Avongrove at 5,500′ on the 3-4-18, having been reported to me on the 1st at 4,500′ around Sungma. (C. E. Brown). In 1919 calling commenced as early as the 19th of March, though the birds did not attain their full vocal powers until a few weeks later. This cuckoo appears to ascend *up to about 9,000′ on the Outer Ranges,* around which elevation, I came across it in the Mai Valley in Nepal. Mr. G. E. Shaw has so far not obtained it above Mangpu beyond an elevation of 3,800′. Birds collected in April 1921, on the 13th were feeding on the earliest to appear, cicada (*Geana sulphurea* Hope.), which was plentiful, and *C. optatus* was also taking this Cicada in numbers as was proved on dissection. During 1923 at Gopaldhara in the Rungbong Valley; the first arrival was noted on the 2nd of April, and while one bird was calling at evening on the 13th of June, its utterances being nothing more than a choking effort; another bird was heard on the 10th of July at its best and others were in evidence calling audibly on the 16th or 27th of the same month.

Six specimens examined: ♂ Wing, 220-230, av., 225; ♀ wing, 204.

Soft parts: ♂ Iris gamboge-yellow; orbital skin yellow; bill greenish-black, deeper on culmen, a defined patch of yellow at the base of the upper mandible-gape bright orange; tarsus yellow. ♀ Iris, yellow; bill horny, greenish; yellow on the lower mandible; tarsus yellow.

418. **The Himalayan Cuckoo. Cuculus optatus** Gould.

The first of the migratory Cuckoos to put in an appearance, arriving at Gopaldhara in the Rungbong Valley about the middle of March; when it ascends to an elevation of over 7,000′. Jerdon has aptly described the call of this Cuckoo which is a sonorous "whut" of four syllables, and the preparatory note at the commencement is quite audible at close quarters. Heard calling on the 27-3-16, and possibly earlier, but not noted down. 12-3-18, calling at mid-day, and possibly few a days earlier. 19-3-19, first occasion heard. 16-3-20, calling for the first time and again on the 19th. On the 25-5-20 I heard this Cuckoo calling at an elevation of 3,550′, but most of the birds appear to be *confined from about 5,000′ and upwards.*

Six specimens examined: Collected from the 31st of March to the 25th of May. ♂ Wing 182-195, av. 186.

419. **The Small Cuckoo. Cuculus intermedius intermedius** Vahl.

I have no information respecting the exact date of arrival of this Cuckoo at Gopaldhara but my record of specimens obtained when the birds are particularly noisy, point to the end of May, and this in accordance with Jerdon's statement as quoted by Oates.as to it being rarely heard at Darjeeling before this time, The earliest date at an elevation of 4,720′ being 11-5-21, and the remainder from the 25th of May to the 5th of June. In the Mai Valley, 24-5-12, *7,000′*, circum. With this exception all were collected at *elevations of from 3,750′-5,700′, chiefly above 5,00′.* Turzum, 5,200′, 12-9-17, ♀ (*a*) juvenile, rolling in fat; caught at a strong moth lamp. (O. Lindgren). Obtained at as low an elevation of 800′ in the Tista Valley. (G. E. Shaw). Eight specimens examined: One ♀ 5-6-20, is in the hepatic stage, so that more than one year must elapse in some cases before the adult plumage is attained. One ♂ 27-5-20, (*b*) shows signs of immaturity in that some of the greater-coverts and primary-coverts have not been moulted, the under feathers of upper tail-coverts are tinged with rufous, a few feathers on the forehead and crown are also rufous. It has a loud call, somewhat resembling the syllables "quik" "four" times rapidly uttered and this is the only call I have heard it produce.

Wing, ♀ (*a*) 150. ♂ (*b*) 146. 5 ♂ ♂ wing, 151-157, av., 154. ♀ wing, 141.

420. **The Indian Cuckoo. Cuculus micropterus micropterus** Gould.

This Cukoo is more frequently heard, if not actually seen at lower elevations than its near congeners. It arrives at Gopaldhara about the second week in

April and *does not appear to transcend an upward limit of 5,000′* where it gives ground to *C. optatus,* whereas *C. canorus* appears not to be hampered by any such restrictions. The surprising number of this parasitic group of birds, both in regard to species and numerical strength is no better proof of the wealth of bird-life in general which can support them all. In 1914 noted to be calling as late as the 4th and 11th of July. First heard calling during the following years: 12-4-15, when on the 19th one call was heard at night. 20-4-16, 10-4-17, and noted as calling after sunset on the 23rd, 12-4-18, 11-4-19, 10-4-21. It is generally silent during July but in 1916 they were noted to have their full vocal powers previous to the 21st. I have not had the opportunity of watching the courtship of any of the Cuckoos with the exception of *C. canorus.*

The well-known call of this Cuckoo has been rendered into common parlance by tea-planters as being best expressed in the term of "make more pekoe," though it may not always be advisable to take the hint and which might be better defined at times as an imprecation. In addition to this vocal effort a rapid thrice or twice repeated "quik" is uttered on occasions. The females seem to be more secretive and do not lend themselves to observation, which is natural during the egg-laying period. During 1923 at Gopaldhara in the Rungbong Valley; the first arrival was noted on the 6th April, calling at night and replied to by another. On other occasions heard on the morning of the 14th of June; on the 19th had lost none of its sonorous notes and still in evidence on the 25th. These latter occasions being the only records noted towards the close of its seasonal vocal efforts. Five specimens examined: ♂ Wing 194-200, av. 197·6.

421. The Large Hawk-Cuckoo. Hierococcyx sparverioides Vig.

Recorded as ascending the Himalayas in summer up to 9,000′ or more.

Resident in the Rungbong Valley, being confined during "the cold weather" chiefly to the forest at elevations around 5,000′. These may be birds which have descended from higher limits? As their place is vacated others probably arrive from lower limits as its numbers are certainly augmented during March and April. The silence of these birds during "the cold weather" is quite as pronounced a feature of their existence as their noisiness is towards the breeding season. So far I have *not obtained it above 6,000* while 4,000′, is the highest limit above Mangpu for Mr. G. E. Shaw's records.

The following dates have reference to the period of its greatest activity. Gopaldhara, 4,720′. First heard calling on the 8-3-15, and again on the 15-3-15. During May there was a lull amongst all the Cuckoos with a recommencement at the last week. Finally heard on the 14-8-15, but only a feeble effort. 14-3-16, calling at evening and again on the 27-3-16. Noted to call on as late a date as the 21-7-16 and on a single occasion on the 11-10-16 which was most unusual, as during July there is a pleasant respite from the interminable volume of sound which prevails throughout April and June. During 1917 a single bird with no others in evidence was calling as late as the 27-7-17. 3,550′, on the 23-2-18, one bird was observed to attempt calling but only managed to effect a two note utterance, the completed effort being attained on the 5-3-18; when a bird was heard to call around an elevation of 4,720′ for three times at 6 p.m. on a dull day. 4,720′. First heard 19-3-19. Gangtok, around 6,000′ much in evidence on the 14-3-20. Gopaldhara at 4,720′ first time heard on the 9-3-21. "The rains" of 1923 were remarkable for spells of sunny weather, most of the rain falling in heavy showers at night which apparently had some influence on the Cuckoos as the pandemonium which reigns all day long and throughout the long hours of the night was certainly not so prolonged as is generally the case. Noted as calling on the 14th of June and during the first week in July when the other species had for the most part finished. The preliminary "chu" "chu" "chu" call heard on the 12th also finally in evidence on the 1st August.

Nine specimens examined : ♂ Wing 217-230, av. 224·2; ♀ wing 217-221, av. 219.

422. The Common Hawk-Cuckoo. Hierococcyx varius (Vahl.).

Recorded for the Himalayas as far as east as Bhotan, ascending the hills in summer to about 7,000′. I have no knowledge of the status of this Cuckoo in the hills. It occurs *commonly in the plains* around Jalpaiguri; on the 18-2-15, it was in evidence judging by its clamorus call emanating on all sides. Not represented in the B. M. series from the Sikkim Himalayas.

423. Hodgson's Hawk-Cuckoo. Hierococcyx fugax nisicolor (Blyth).

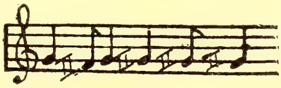
Recorded for the Himalayas as far west as Nepal. Its *distribution is extended* by the record of a specimen obtained at 4,500′ above Mangpu, ♂ 7-5-20, (G. E. Shaw), in the hills *to the west of the Tista River*, though Mandelli is mentioned p. 384 in Vol. II of "Hume's Nests and Eggs" (Oates) as having obtained an oviduct egg from a specimen, exact locality not stated.

424. The Rufous-bellied Cuckoo. Cacomantis merulinus querulus Heine.

Recorded for the Eastern Himalayas from Nepal. I have no knowledge of this Cuckoo; which commonly occurred in the plains of Upper Assam, as to its status in these hills. Not represented in the B. M. series from the Sikkim Himalayas.

425. The Indian Plaintive Cuckoo. Cacomantis merulinus passerinus (Vahl.).

This Cuckoo occurs around Gopaldhara as a migratory bird in the summer, yet its appearance is somewhat irregular. During 1916, first heard to call on the 27th of March and in evidence on the 15th of August. During 1920, two ♂ ♂ obtained in the compound at 4,720′, 14—16-5-20, and noted again on the 19th. It has two calls : the first is best described in the syllables "pe" "peah" and to be often followed by a mournful effort of three notes, generally uttered in semi-tones thrice in an ascendant scale rendered in syllables "tay" "tā" "tay" or "dhay" "dā" "dhay", but more effectively.



During 1923 the preliminary call was first heard on the 4th of April. In evidence on the 13th of June and from the 11th to the 16th of July which last date was the final occasion on which it came under my notice.

Two specimens examined : ♂ Wing, 115-120.

Soft parts : Iris venetian-red or pale crimson-brown; tarsus dusky-yellow; soles ochreous; claws dark horny-yellow.

426. The Banded Bay Cuckoo. Penthoceryx sonneratii sonneratii (Lath.).

Obtained on one occasion in the Tista Valley at 2,000′. (G. E. Shaw). Represented in the B. M. series by one specimen from Darjeeling and one specimen from Sikkim, April 1873.

427. The Emerald Cuckoo. Chalcococcyx maculatus (Gm.)

A summer migrant of rare and irregular occurrence to the Rungbong Valley Easily overlooked in dense foliage. On its arrival at Gopaldhara in April, it is remarkably devoid of fear and shows a disinclination to avoid any possible chances of danger, trusting to its harmonizing plumage and unobtrusive habits for protection. I regret my inability to describe its call which is quite distinctive from any of the other Cuckoos and notwithstanding its weakness in volume savours of cuculine pecularities. On occasions its vocal strains are produced during the stillness of the night. Information in respect to it is as follows: Gopaldhara, 4,500′, ♀ 11-4-18, ovaries active; a few birds seen, but the first to be obtained by a youth who had knocked it down at short range. 4,250′, ♂ 2-5-18. Three birds reported to me as having been seen by an intelligent chaprassi on the 22-4-18. 4,720′, 17-4-19. My attention was drawn to two pairs of this beautiful Cuckoo this morning as they were busily occupied making a systematic search of the foliage of the cherry trees. They were allowed to complete their task without molestation and the caterpillars suffered a diminution of their numbers accordingly.

During a partially weak ? monsoon in 1920, they appeared to be totally absent. The "Fauna" key to the species of this genus, as always seemed confusing, the distinguishing characters between the female of this species and "*xanthorhvnchus*" are evidently transposed, and comparison and checking by the description shows this to have been the case.

1923. Gopaldhara, 6,000′. Juvenile females within a few days of leaving the nest were brought in on the 13th of June and 7th of July, The nests of the foster parents (*Cryptolopha castaneoceps*) out of others which I got eggs, having been found on previous occasions.

428. The Indian Drongo Cuckoo. Surniculus lugubris dicruroides (Hodgs.).

This Cuckoo arrives in the Rungbong Valley about the middle of April, or in some years, during the first week in April. At Mangpu, 3,860′, seen and heard as early as the 25-3-15. Gopaldhara, 4,720′, heard on the 2-4-15. 3,500′, in the bottom of the valley, 13-4-16, and again at 4,720′ on the 25-4-16, finally noted as calling on the 19-7-16. 4,720′, in evidence, 19-4-18.

I have gone into a long list of dates in reference to many of these Cuckoos at the period of intense sexual activity, as an aid in determining its duration, and at the same time in fixing their arrival, if not always their departure. Meanwhile my notes on oology will of necessity have to stand over until a future occasion.

429. The Pied Crested Cuckoo. Clamator jacobinus (Bodd).

Recorded for the Lower Himalayas. Unknown to either Mr. G. E. Shaw or myself. It would be an interesting fact, if the route were known of the specimen obtained at Tingri, 14,000′, by the Mount Everest Expedition. (*vide* Kinnear N. B., Ibis, Vol. IV, No. 3, July 1922, p. 504.)

430. The Red-winged Crested Cuckoo. Clamator coromandus (L.).

Recorded for the base of the Himalayas and farther east. The only locality known to me is that supplied by Mr. G. E. Shaw from below Mangpu at elevations of from 2,500′-3,600′ in the Tista Valley where specimens have been obtained as follows: 2,500′, ♂ 5-6-19. 3,500′, ♀ 22-4-19. 3,600′, ♀ 16-4-20. Mandelli appears to have obtained it from Namchi.

431. The Large Green-billed Malkoha. Rhopodytes tristis (Less.).

Recorded for the Outer Himalayas below about 8,000′. Obtained up to an elevation of 3,860′ at Mangpu. (G. E. Shaw). In the Rungbong Valley, it has an extension to the head of the valley up to 3,600′, being confined to the river-bed and surroundings as a resident. So far I have not seen it in any other locality hereabouts.

432. The Hill Sirkeer Cuckoo. Taccocua leschenaultii infuscata Blyth.

Recorded for the Lower Himalayas, and evidently referable to this form which, however, is unknown to me.

433. The Chinese Crow-Pheasant. Centropus sinensis sinensis (Steph.).

Occurs in the Tista Valley up to 3,600′ below Mangpu. (G. E. Shaw). I have no record of its occurrence in the minor valleys to the west.

434. The Indian Lesser Crow-Pheasant. Centropus bengalensis bengalensis (Gm.)

Recorded as occurring up to about 5,000′ in Sikkim according to Gammie. Once only observed at Gopaldhara in the Rungbong Valley at an elevation of 3,440′, 28-1-15*; when it was flushed out of a reed-bed. As these Coucals are dependent on the necessary dense cover; it can only be locally distributed and absent from large tracts of the country.

435. The Large Assam Paroquet. Psittacula eupatria indoburmanica (Hume.).

Recorded for the Sikkim Terai; which statement also refers to
Psittacula cyanocephala cyanocephala (L.), and
Psittacula cyanocephala bengalensis (Forst.).

436. The Slaty-headed Paroquet. Psittacula schisticeps schisticeps (Hodgs.).

Recorded throughout the Himalayas below about 8,000′. This Paroquet performs an upward movement into the Rungbong Valley at the end of "the rains," when large parties may be observed in flight, attracted to their favourite feeding grounds which consist of berry-laden trees. Blanford gives *P. s. schisticeps* with a wing measurement of 6·5″ = 165, and a total length of 16″ against *P.s. finschi* with a wing measurement of 6″=152 in males and a total length ot 17″. These total length measurements evidently require reversal as the former is the bigger bird of the two.

437. The Indian Red-breasted Paroquet. Psitaacula alexandri fasciata (P. L. S. Muller).

Recorded throughout the Lower Himalayas up to about 5,000′.
Obtained in the Tista Valley up to 3,800′. (G. E. Shaw). Only seen in the Rungbong Valley during "the cold weather"; which is a movement evidently connected with the shortness of the food supply, necessitating a wider area to be covered. As is well known these Paroquets in common with the rest take safety in numbers, and whilst the screeching that takes place may be the means of warning all laggards; it can only result in drawing attention to the flight, even if undertaken with great rapidity. The breeding habitat lies in the foot-hills to which reference has previously been made.

438. The Indian Loriquet. Coryllis vernalis (Sparm.).

Recorded from the Darjeeling Terai, eastwards to the Bhotan Duars and Assam. Authentic reports of its occurrence under the foot-hills of Bhotan have been given me, but so far I have not been able to substantiate its reported occurrence in the Rungbong Valley during "the cold weather", in which case it is a similar extension upwards along the bed of the river, at a time of food shortage.

439. The Bay Owl. Photodilus badius (Horsf.).

Strictly confined to the heavy forest of the Foot-hills from where I have seen only a few specimens, inclusive of a record for the Tista Valley,2,000′, 20-11-15 (G. E. Shaw).

440. The Short-eared Owl. Asio flammeus flammeus (Pontoppidan).

An irregular cold-season visitor on the *Outer Ranges at moderate elevations on its southerly migration* to the plains. Observed quartering the "dharas" at Okayti on the evening of the 27-12-21.* My specimens have been obtained in exposed ground on the ridges on both sides of the Rungbong Valley. Gopaldhara, 6,100′, ♀ 24-2-18. Turzum, 5,200′, ♀ 2-2-15. (O. Lindgren).

These two specimens compare similarly in colour and measurement with a ♀ from Tirhut, 21-12-04. (C. M. Inglis). The three ♀ ♀ measure: Wing 307-310, av. 309. whilst a ♂ from Hessamara, Upper Assam, is altogether paler with the streaks on the under surface much finer. Wing 294. Dr. Hartert does not consider this specimen to be referable to "*leucopsis*" (Brehm). The status of this Eastern form is obscure.

441. The Himalayan Wood-Owl. Strix aluco nivicola—(Blyth).

Recorded for the Sikkim Himalaya at elevations of 6,000′-14,000′.

This owl may not be so rare as it is generally supposed to be, in consequence of its nocturnal habits and high altitudinal distribution. Tonglo, Nepal-Sikkim Frontier, 10,000′. The first clue to this bird's whereabouts was the finding of a few feathers in the vicinity of some huge boulders in January 1911 ; evidently one of its haunts on the south face of the mountain, but it was not until the 17-5-12 ; when in camp at Kalo Pokhari at 10,160′, that I was able to obtain a specimen, a male being brought in by a "paharia" youth from the valley below in Nepal. Wing 290. Bill greenish-yellow. Stomach contained remains of Coleoptera, also a portion of a vole's skull, probably *Microtus sikkimensis*, several of which were trapped near my camp.

442. The Himalayan Brown Wood-Owl. Strix indrani newarensis Hodgs.

Recorded from the base of the hills up to 13,000′ in Sikkim.

A nocturnal owl, sometimes to be seen on occasions in the depths of forest towards evening, at elevations of from 5,500′-6,000′ at Gopaldhara; when it is on the alert, as if anticipating an attack from above and not as mindful of danger from below. The bird takes flight on the slightest audible noise at one's approach, and this is unavoidable as it is impossible to avoid crunching the thick layer of dry decayed leaves which carpet the ground, so common a feature in tropical forests and forests of moderate elevations in "the cold weather". It frequents the wooded portions in the station of Darjeeling, and occurs around Mangpu at elevations of from 3,600′-3,800′. (G. E. Shaw). Messrs. Barrett and

Shaw have both kept this Owl in semi-captivity, and it makes a docile and interesting pet when taken young. A pair disturbed in the forest at 6,000′ on Gopaldhara, 13-5-23*.

Three specimens examined: Gopaldhara, 6,000′, ♀ 27-1-18, one of a pair, wing 381. ♂ 10-3-18, wing 363; testes well advanced in development. 5,500′, ♂ 17-5-20, wing 385. Iris brown ; bill pale greenish-horny.

(*To be continued.*)

REVIEWS.

I. IN THE HIGHER HIMALAYAS. By H. Whistler, F.Z.S., with 31 Illustrations from the author's photographs. 219 pp. Witherby & Co., London, 1924. 15 *s*.

Our well-known member and writer on the Birds of the Punjab, Mr. H. Whistler, has now given us a book on his travels and exploration "In the High Himalayas" It is well named as the author deals with nothing under 10,000 feet in height and confines his account pretty well to the little known provinces of Lahul and Spiti, the last outposts of the administration of the Punjab ere Tibet and Ladak are reached. The author starts us off up the Rhotang Pass from Kulu into Lahul and thence by easy stages to Gondla, where the Thakur of the Lahul has his castle. The author describes, as only one who is trained in natural history can do, the natural features, peoples, religion, customs, vegetation and fauna of this little known part; something of interest about all these being worked into a very readable narrative, since the chapters are not a mere diary but, a masse account from more than one visit. From Divil Daras and the Patseo Fair—the Wembley of the Tibetans and Lahulis—which are well described, we are introduced to the Ibex of Lahul, opportunities being taken *en route* for a little Shikar, sometimes successful, sometimes otherwise; but the difficulties of climbing and stalking at 13,000 feet or more must indeed be great while many a good chance is spoilt by the "Guardian of the Ibex", the great Snow Cock, as he rattles off down the hill side.

A detour through Spiti, a very little known country, is described with a wealth of detail which makes very interesting reading and an insight into the manners and customs of these remote people is afforded, while a visit to the famous Kyi monastery was successfully accomplished despite the obvious suspicions of the Lamas. A chapter itself is devoted to the wild Sheep of Spiti and the Burhel—and a cheerless camp at 16,000 feet on a bare hillside was compensated by some good stalks and fine heads.

The final chapters give a good account, unexaggerated and unadorned, of a day's Monal shooting with a dog and a 20 bore and a graphic account of a bear hunt in the Solang Nullah in Kulu, while the sights and attractions to visitors to the Kulu Valley has a chapter to itself. Lastly there is a short *Resume* of the birds ordinarily encountered in Lahul and Spiti and how the traveller may recognize each.

The book is well illustrated by photographs from the author's camera and a map is given to shew the position of the places visited. A very readable book. Those who know and love the Himalayas should get it. those who have never been there should read it and take it with them when they go as it is full of useful tips on travel and sport.

C. T.

II. BIRDS OF AN INDIAN GARDEN. By T. Bainbrigge Fletcher and C. M. Inglis. With 30 coloured plates and numerous Illustrations in the Text. 161 pp. Thacker Spenk & Co., Calcutta, 1924. Rs. 12.

There has recently appeared in the Indian Agricultural Journal a series of papers on "Some Common Indian Birds" under the joint authorship of Mr. Bainbridge Fletcher and Mr. C. M. Inglis. These are now being published in book form, in parts, under the title of "Birds of an Indian Garden."

Thirty different birds are dealt with and the book contains articles on the Jungle Crow, Indian House Crow, Bengal Tree Pie, Bengal Jungal Babler, Bengal Red-vented Bulbul and King Crow, etc.

The author has been well advised in following the nomenclature of Mr. Stuart Baker's list and the new volumes of the Fauna, but we think that in a popular work of this kind trinomials are out of place and to the general public the Indian Tree Pie, whether it comes from Calcutta or Madras, is one and the same bird. In the case of the familiar Seven Sisters surely it would have been better to head the article " Jungle Babblers " and to mention the various common species found in different parts of the country. As it is the common Babbler of Bombay *Turdoides somervillie* is not even alluded to.

Under each species there is a general description of the bird and an account of its habits, next eggs and food, as far as is known. Coloured plates from paintings by Mr. Inglis accompany all the articles, and considering the price of the work these are quite well reproduced. but we would recommend Mr. Inglis not to attempt birds in flight—a very difficult subject and one seldom correctly achieved even by professional artists. The black and white drawings are the work of the artists at Pusa who are obviously more at home in drawing insects than birds, otherwise the Indian Tree Pie and Drongo would be more comfortable on their perches.

In spite of these drawbacks the illustrations will be very helpful in identifying the different birds and nature lovers in India will find much of interest in what Mr. Fletcher has to say about the various species.

This is we believe the first time a popular book with coloured plates has been published on Indian birds and we hope it will be the forerunner of many more.

The Society has a comparatively small number of Indian members, but that is not surprising since there is a great dearth of popular works with coloured plates on common Indian animals to rouse an interest in Natural History. A few more books like the present one should do much to help and, indirectly let us hope at the same time add to the membership of the society.

N. B. K.

III. A GENERAL TEXT BOOK OF ENTOMOLOGY. BY A. D. IMMS. London Methuen & Co. ; March 1925 ; pages XII+698 with illustrations ; 36 shillings nett.

On the general subject of Entomology books a-many fill our shelves and bear witness to the progress of our knowledge of the study of insects. The earlier ones, of the seventeenth and early eighteenth centuries, were usually written in Latin, and are exemplified by Goedart's *Metamorphosis et Historia Naturalis Insectorum* (1662) and Swammerdam's *Historia Insectorum Generalis* (1733), with their quaint illustrations. The introduction of the binomial system, by which all animals were given a generic and a specific name, facilitated the recognition of different kinds of insects so that the second half of the eighteenth century saw the issue of numerous descriptive and iconographic works, of which those of Fabricus and Cramer may be taken as examples. About the same time the use of Latin began to fall into disuse, at least in the case of books on insects of local interest or of essentially popular publications, such as Yeats' *Institutions of Entomology* (1773). These led the way to more detailed books, such as Kirby and Spence's *Introduction to Entomology,* and this period closed about the time of the issue of Westwood's excellent *Introduction to the Modern Classification of Insects* (1839). Thereafter there commenced the period of specialization as, with the growth of knowledge, it soon became impossible for any one man to become and keep himself acquainted with progress in all branches of Entomology. Oliver Wendell Holmes drew an intentional caricature in his pen-portrait of the Scarabee, who could not claim to be an entomologist, or even an authority on Beetles, but who devoted himself to one group of these insects only ; but here once more truth has outrivalled fiction and the present day sees the Scarabee himself divided into specialists in various groups of Scarabaeid beetles. The growth of specialization is not, of course, peculiar to Entomology but has proceeded equally in all branches of knowledge, yet it is usually not realized what an enormously large field is covered nowadays by the study of insects, a field whose boundaries impinge on those of Commerce, Agriculture, Forestry, Medicine, Veterinary Science, Education, Zoology, Geology, Genetics and numerous others. General Text-books on Insects therefore meet a need of all modern entomologists as well as of those with a more general interest in the subject, and this need has been met by the issue of numerous publications of which it would be tedious to give any detailed list. One of the most successful of the English text books has been Sharp's two volumes in the *Cambridge Natural History* (1895, 1899) but these, though excellent in their day, have been rendered rather out-of-date by the very considerable accessions to knowledge during the last thirty years.

It is, therefore, with considerable interest that the working entomologist examines each new Text-book as it appears to see how far it will help him in his work. Many are merely elementary or popular, some are frankly poor, and others are excellent. In this last category we may place Dr. Imms' *General Text-book of Entomology*, which has just been published, and whose aim, in the author's own words, "has been to present the chief facts concerning the structure, physiology, development and classification of the Insecta and the biology of their more important representatives.... .... The object throughout the book has been to present before the reader essentials but, at the same time, to indicate where fuller information is available." These objects have been admirably attained, the subject-matter being dealt with in three sections, (1) Anatomy and Physiology, (2) Development, and (3) Classification, each section being fully illustrated and accompanied by adequate lists of literature.

This book comprises 700 pages and is throughout well-written, well-illustrated and well-produced. There are a few minor corrections which will doubtless find their way into a second edition : meanwhile, Dr. Imms' Text-book should find a place, and largely replace Sharp's volumes, in every entomological library and laboratory.

T. B. F.

EDITORIAL.

THE Committee of the Society wish to record their thanks to Mr. F. V. Evans of Hayman's Green, West Derby, Liverpool, for the valuable books recently presented by him to the Library. The books received are Gould's "Birds of Asia" in six volumes and a "Hundred Birds of the Himalayas" by the same author. The books are beautifully illustrated. Mr. Evans has also expressed his willingness to present the Library with such other books as we may be in particular need of. The Society is further indebted to Mr. Evans for his presentation of oil paintings and prints illustrative of old Bombay and its neighbourhood. It has been decided to place these pictures on exhibition in the Art Gallery of the Prince of Wales' Museum, where they will be of no little interest to both visitors and residents of this City. We feel sure that members of the Society will join us in expressing our appreciation of Mr. Evans' very generous donations.

The Museum has also been fortunate in receiving some valuable gifts among which is a fine head of the Himalayan Grey Goral (*N. goral*). The horns measure 9¼", a record ! The head was presented by Mr. H. Simmons who shot the animal some years ago in the neighbourhood of Mussoorie. A photograph and a reference to this trophy appears in Col. Ward's serial on the "Game Animals of Kashmir and the Adjacent Hill Provinces" on page 130 of this volume. Another fine acquisition is the head of a Nilgiri Thar (*H. hylocrius*) with horns measuring 16½"×9½" presented by Capt. H. R. Irvine. This is very nearly the record. These trophies make very welcome additions to the Society's collection of heads of Indian Big Game now exhibited in the Prince of Wales' Museum. Continuous progress has been made in the Museum during the past year—in addition to the mounted Gaur recently placed on exhibition we have now been able to show a fine example of a fully set-up Kashmir Stag received from Col. Burton.

Col. Burton has also presented the museum with a good example of the C. P. 'Barasingh' or Swamp Deer. Good complete skins of the Sambhar, the Brow-antlered Deer and the Hog Deer are still required to complete our exhibit of Indian Deer. We hope that next shooting season some reader of the Journal will help us to fill these deficiencies. The subject of shooting prompts us to refer to the further notes and comments on Mr. Dunbar Brander's "Wild Animals of Central India" published in the present issue. Mr. Dunbar Brander's book is unquestionably the best and most informative work of its kind that has appeared within recent years and the comment it has occasioned sufficiently indicates the general interest it has aroused. In a review of the book which was printed in Vol. XXX, No. 1 of the Journal, the reviewer in commenting on the manner in which the Sloth Bear attacks human beings, remarked that the question is one of some interest and that careful and detailed reports by Civil and Agency Surgeons and their subordinate medical establishments, as to the cases of mauling by bears which come to their notice, would probably clear up the question. He now writes to the effect that it is more than likely that many injuries said or supposed to have been caused by the claws are the result of bites and that such a case has come within his own knowledge and observation. Will members of the Society, both those of the Medical profession and others who are in a position to make notes on such cases or to cause them to be made, collect as much material as possible to confirm or refute this view. The point raised is one among many which might well be answered by sportsmen-naturalists.

Few countries in the world offer such unlimited scope as India does to the Amateur Naturalist for the prosecution of his hobby. To take for example the subject of Indian Bird Life in which so many are interested—how little is known of the local migration of Indian Birds ; certain common species appear in a given locality at a certain date and depart at another. What is the date of arrival and departure ? The subject of distribution of Indian Birds, both general and altitudinal, has still to make considerable headway before we can be abreast of what is known of this in Western countries. There are besides such interesting subjects as colour variation and hybridization in Birds. In the *Field* of April 30th, 1925, there is a beautiful drawing by Frohawk of a hybrid Mallard and Pintail which was shot in Sussex; many instances of hybridization amongst our wild duck must come under the notice of shikaris, a list of these occurrences would be of no small value. Further there are observations to be made on the food and feeding habits of birds, their methods of courtship and display, nesting habits, variation in the eggs, size of clutches, etc. All accurate observation on these phases of bird life would be valuable and merit placing on record. In Western countries an enormous mass of information has been made available by numerous observers whose initial interest in the subject can be traced to the numerous, easily accessible, cheap, readable and well illustrated books on the Natural History of the country. That there is a dearth of such books in reference to India we have already pointed out. It is for this reason that books, such as " Birds of an Indian Garden " by Mr. Bainbrigge Fletcher and C. M. Inglis which is reviewed in the present number, are always welcome. The book, as the authors state in the preface, is mainly intended for those whose pleasure in observing our Common Indian Birds is in a great measure lessened by their want of knowledge of the birds concerned. There must be many in India both European and Indian to whom the " Birds of an Indian Garden " will appeal and to these we gladly recommend the book. We also take this opportunity of congratulating the authors on the able manner in which they have helped to fill a long felt want. The book is illustrated by 31 coloured plates and is remarkably cheap at the price at which it is offered. Naturally, coloured illustrations are an asset to a work of this type as they go a long way in helping the reader to recognise the species described. This bring us to the point that the present number of the Journal is the first for many years which is not prefaced with the usual coloured plate illustrating Mr. Stuart Baker's popular serial on Indian Game Birds. Mr. Stuart Baker, in addition to the arduous task of rewriting the Volumes on Birds in the Fauna of British India series, has found time to maintain unbroken the sequence of his very interesting articles on Game Birds. He now proposes to complete the work by a serial on the Wading Birds, but unfortunately the Manuscript and the coloured plate were not ready in time for inclusion in this issue, we hope, however to be in a position to commence the series in the next number.

By the time the Journal is in the hands of members the monsoon will be on us and the rains will inevitably be followed, in most districts, by redoubled activity on the part of the pestilential mosquito. It will come as news to many that the Coconut Palm stands condemned as a potential nursery for these disease-bearing insects. A mosquito survey of the palm trees in Tanga, East Africa, by Dr. Haworth has led to the conclusion that the local mosquitoes breed freely on the crowns of the coconut palms almost continuously throughout the year and even in times of comparative drought, when collections of storm water have subsided and when rot holes in trees have evaporated, the crowns of the palms appear to act as reserve breeding grounds from which other suitable places may be stocked wherever these appear later from rainfall or other causes. In a notice of Dr. Haworth's report which appears in the review of Applied Entomology for March 1925 it is stated that " what has been demonstrated for a portion of the East Coast of Africa is probably taking place in tropical lands throughout the world, wherever the coconut palm flourishes, and no successful anti-mosquito campaign can therefore ignore the coconut palm as a possible breeding place for these insects. . . . The treating of the crowns with oily or larvicidal substances, owing to the labour involved and the periodical mechanical damage to the crowns, would be impracticable. The clearing of coconut palms from the neighbourhood of all inhabited areas would be economically impossible, but it is suggested that the planting of coconuts should be prohibited within towns and cities and that all Government owned palms should be immediately removed. "

MISCELLANEOUS NOTES.

No. I.—BREEDING SEASON OF THE NILGIRI LANGUR.

Does the Nilgiri Langur breed twice a year, or does the breeding season differ according to latitude, or according to altitude ? I append the following observations in reference to the subject:—

(1) At Kodaikanal, 7,000 feet altitude.

8th May 1919, I shot a large female ; a fully formed young one in the womb.

5th June 1919, I saw a female with a young one clinging to her breast.

20th April 1920, I shot a female with a young one in her arms. I tried to rear the one, but it died after two days.

(2) At Kattali Malai, 20 miles west of Ambasamudram in the Tinnevelly District, 4,000 altitude.

28th December 1924, a friend of mine fired at a langur, which got away leaving behind a young one.

29th December 1924, another young one was brought to me by a shikari. These two were only a few days old. They died three days later in spite of all our efforts to rear them.

C. LEIGH, S. J.

TRICHINOPOLY,
13*th January* 1925.

No. II.—WILD DOGS AND JUNGLE TRAGEDIES.

Dunbar Brander, writing on the Wild Dog in his excellent book " Wild Animals in Central India " (which by the way all should read), says he has never heard of wild dogs attacking bear or bison, but that he has no doubt that the latter are sometimes killed. I sometime back sent you a note* on wild dogs attacking a bear, an occurrence witnessed by Col. H. K. of Bangalore and myself while out after bear in these jungles (the Billigirirangans) last May. The bear was making for its cave, but I doubt whether it would have reached it. Its progress was very slow, attacked as it was, by about eight to a dozen dogs all round it. Dogs in front would engage its attention while those behind attacked its hind quarters ; the bear would then turn round on the latter and instantly the dogs in front would again divert its attention to them by rushing in, but out again before the bear could touch them. The bear let out a series of coughing roars each time he turned on his tormentors in his rear. It was a bear my friend was out after and the bear was therefore bagged, and I regret to say that we were unable to slay a single dog.

With regard to wild dogs killing bison I have never heard of cases of mature bison being killed by them but I have twice come across cases of bison calves having been killed by them and in each case I think the dogs had stampeded the herd and cut off the calf.

I have twice come across sambar standing in water up to their shoulders and screaming and once swimming, and in all cases the dogs were all round them and hanging on to them. On each occasion I drove the dogs off, bagging several, but I fear that they got on their victim's tracks again.

In 1916 I saw the remains of a panther that had been killed by wild dogs in a Sholaga's " podu ". The Sholagas described the fight to me, it had been fast and furious, the panther rushing backwards and forwards was eventually disembowelled by the dogs that kept pace with it. I could find no traces of any dogs having been killed and the Sholagas declared that none were injured. The scene took place in clear view of their huts. That however the reverse sometimes occurs is proved by the fact that Mr. C. W. G. M., of these hills, not long ago came across the remains of two wild dogs that had been killed and eaten by a panther.

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* *Vide* Vol. XXX, Miscellaneous Notes, p. 218.

Cases have undoubtedly occurred of tiger being killed by the dogs. I was informed of a case of this nature by my tracker some years back and his story was corroborated by others who were co-witnesses of the scene and I have no reason to doubt their tale. In this case apparently the men saw the tiger loping along at a good pace with dogs keeping pace with him and snapping at his sides and hindquarters: they then saw the tiger leap on to a tree which leaned over nearly horizontally. The dogs trotted all round while one, apparently the leader, of the pack, leaped into the air repeatedly, ineffectively trying to reach the tiger. After a time the tiger, tiring of his uncomfortable position, suddenly made a tremendous leap over the dogs' heads to the ground and here met his death, being disembowelled by the dogs as he barely touched the ground.

Wild dogs attacked a sounder of pig last year in the shola behind my bungalow and tore two sows to pieces before they were driven off by my servants. Although some distance away I heard the sows screaming and later saw what was left of them.

Wild Dogs are not the only perpetrators of tragedies in the jungle: tiger and panther take their toll on deer and antelope and on other game: Dunbar Brander mentions coming on a bear blinded in a fight with a tiger and Capt. H. J. L. F., of these hills, not long back came on a spot in these jungles where a tiger had attacked and killed a bear after a terrific battle, and had then eaten it. In the same way some years back I discovered traces of a fight between a tiger and a bear after hearing a hideous din the previous night: I was in camp at the time, the noise lasted for about half an hour. There was a good deal of black hair lying about, a little of the tiger's hair, and a fair amount of blood: there was no drag. In 1916 I saw the remains of two big bull bison that had been killed by a tiger, one a fortnight after the other: and I have twice seen the remains of cow bison that had been also killed and eaten by tiger. I was informed by the Sholagas that a tiger would follow and attack a bull bison for days until it fell an easy prey through utter weariness. In 1915 Mr. C. W. G. M. saw a tiger attempting to stalk a herd of bison, but in this case the herd had already seen the tiger: Mr. M. managed to bag the tiger. Tiger generally avoid a conflict with wild boar, but I have frequently seen remains of sows killed by tiger, and on one occasion those of a large boar, which the tiger had evidently caught unawares. Mr. C. W. G. M. once bagged a tiger standing over the body of a fine stag sambar hwhich it had just killed, the death cries of the stag in fact having drawn Mr. M. to the spot: the tiger's sides were still heaving with the exertion of pulling down the stag. I witnessed a never to be forgotten sight in November 1917; a stag sambar, after belling three times suddenly dashed out of a shola not far from me followed a few paces behind by a large tiger: the stag had not as yet got into its full stride and in a moment the tiger had overtaken and brought it down: I had a clear view of the stag crashing down with the tiger on its back and in a second the tiger was at its throat and all was over. In my excitement it never occurred to me that I was in full view of the tiger till too late, the tiger saw me and slunk quickly off into longer grass, giving me no chance to get in a shot, and then into a shola which the grass led up to. I need not here describe how I lost this tiger entirely through bad management on my part. I have known animals meet their death in unusual ways in the jungles: I once came on the remains of a panther that had met its death by attacking a porcupine: its decomposed head was run through and through by no less than seventeen quills, two of which had penetrated the eyes into its brain. Its paws were also full of quills. The panther had evidently rushed the porcupine which, seeing it in time, had quite obviously whirled round presenting its back to the panther with quills erect, such being their method of defence. There was no sign of the porcupine having been killed.

A few years back Mr. C. W. G. M. hot a stag sambar which, in attempting to escape, had got itself entangled in a mass of stout creepers in an extraordinary fashion. The stag was undoubtedly being throttled. In 1918 three cow Elephants died within a few *yards* of each other not far from my Estate: the local Forest Ranger put their deaths down to anthrax, but I doubt this as these elephants had formed part of a large herd and no further deaths were reported. Sholagas informed me that they had probably died through eating poisoned pumpkins in the fields at the foot of these hills. This herd had been in the habit of visiting the cultivation down below and the idea was that the ryots had put out poisoned pumpkins in the hopes of killing off one or two, if so, their hopes were amply fulfilled! It is anyhow most remarkable that the three elephants should have died in a bunch as it were. I visited the spot as soon as the state of the remains had got beyond the overpowering stage; the elephants had died not twenty yards from each other. I now come to an event which to my mind is the most extraordinary occurrence I have ever witnessed or heard of. In September 1915, while out on shikar, I wounded a wild boar in a deep valley and on following it up came on it lying down about half a mile further up the valley. The jungle here consisted of dense bamboo of the smaller type. I put a shot into the old boar which finished it off, and immediately after heard crashes to my right and left front, the next second a tusker and a large solitary bull bison appeared in view careering from opposite directions along two elephant paths that ran, cutting each other, across our front and away from us (two trackers were with me), and behind a clump of bamboos, where the two paths crossed, the tusker and the bull bison met. There was a tremendous thud and the bison was lifted off its feet and flung against another bamboo clump where it lay with a gaping hole in its left side caused by the elephant's left tusk. As they met the elephant emitted a noise through its trunk like escaping steam. The tusker did not pause but carried on along the path and later met my tiffin cooly and, the man said, chased him, with disastrous results to my lunch. I approached the bison: it seemed incapable of moving and ay breathing heavily, obviously dying. I finished it off with a throat shot. The elephant's tusk had penetrated the bison's body to the depth of a foot or more. The bison carried quite a good head. Now the question arises, did the two animals accidently collide? or, finding himself in such close proximity to the bison and thinking the latter was responsible for the disturbance, did the tusker deliberately ram the bison? I am inclined to the latter view and my trackers agreed with me. I think that both animals could have swerved sufficiently to allow each other to pass without colliding had they so desired: possibly the bison did swerve but the elephant probably counteracted this by swerving inwards or keeping straight on. It is unfortunate that the actual impact took place behind bamboos and was thus hidden from our view. Both animals had been thoroughly disturbed by my shot which in the valley had been magnified. The wind was blowing down the valley which accounted for the fact that my first shot had not worried them. A year or two later a well known Planter and Sportsman of Coorg told me that a very similar occurrence had been witnessed by his Kurumba tracker in those jungles, the elephant in this case being a rogue. In May 1919 Capt. H. J. L. F. shot a proscribed rogue elephant in these parts: near by were the remains of a solitary bull bison that had been killed and trodden out flat by the elephant. It should be interesting to hear of further details of tragedies in jungle life observed by members of the B. N. H. Soc.

R. C. MORRIS.

ATTIKAN *via* MYSORE,
S. INDIA, *October* 15*th*, 1924.

No. III.—" WILD ANIMALS OF CENTRAL INDIA ".

Panther.—In his Chapter on Leopards and Panthers in "Wild Animals of Central India" the author mentions that three or four leopards will sometimes be seen together. In 1921, a family of 6 panthers were killing on the borders of my Estate: the family comprised the parents, two three-parts grown panthers, and two small cubs. On approaching their kill the family would come out of the Shola in the above order, one behind the other. Needless to say the family did not remain long united, the parents and the three-quarter grown ones being bagged in a very short time.

Sambar.—Writing of the sore place so commonly seen at the base of a Sambar Stag's neck the author remarks that he has associated the phenomenon as being in some way connected with the new growth of hair. I think he is mistaken in this, as I have seen sambar with this sore place from September to April both on these hills (the Billigirirangans) and on the Nelliampathies (Malabar). It is generally an open sore about the size of a rupee in some cases, and much larger in others, surrounded by a large bare hairless patch. I have never seen a hind bearing this sore, and not all stags have it. I should say it was undoubtedly formed by a fungus that grows in the hair or skin, as in ringworm, the bare patch round it being the result of the sambar rubbing itself against branches, etc.

Chital.—Writing on the chital stag's roaring the author describes it as "of the nature of a whistle but louder and longer than the cry of alarm". I would not describe the call as in the nature of a whistle at all. In fact the call, as I have heard it uttered on innumerable occasions at the foot of these hills, is not unlike the hoarse cry of a man, lowering in note as it ends off.

Muntjac or Barking Deer.—In writing of the " clicking" noise muntjac are frequently heard to make when galloping off the author says : " Several previous writers have referred to a peculiar rattling noise they make when moving away ....I have no doubt that the sound referred to is the same as that which I have described above " (here the author refers to his description of the muntjac's short, sharp, jerky barks frequently given out while galloping off in alarm). On reading the above one cannot but gain the impression that the author has not heard the "rattling noise" other writers have referred to, for no one who has heard this peculiar clicking noise could possibly confuse it with the short jerky barks given out by a muntjac when alarmed and bounding off. This rattling or clicking noise can best be described as the noise made by knocking two bones together sharply and rapidly with a pause between every third stroke. I share the belief that this noise is caused by the cloven hoofs of the animal coming together at every bound. The noise is only heard when the muntjac goes off in a clumsy bounding gallop, and never when it *rushes* off at full speed.

With regard to the muntjac's pedicles I have seen several heads of muntjac shot here with 5″ pedicles. Another interesting fact is that the muntjac on these hills is a larger animal in body and skull altogether than those elsewhere in South India.

The Four-Horned Antelope.—The author remarks that in some cases the growth of the anterior horns of this little animal " seems to be altogether arrested." This certainly applies to the Four-horned Antelope to be found on these hills, which have only two horns (the posterior ones—a good head carrying horns about 4½″ in length), no sign of the anterior horns being apparent. The author further remarks that this little antelope " is not gregarious, and is found singly or in pairs, the two fawns accompanying the parents until the rains" this is so as a rule, but I have however on two or three occasions seen groups of 5 or 6 mature four-horned antelope, especially on one favourite hill-top here.

Bison.—In his chapter on the Indian Bison or Gaur the author writes : "Two bulls of about the same age often consort together and I once shot two old bulls, right and left, leaving a village tank in Chanda. This is the only case in which I have ever known bison to approach the habitations of man*''. Bison, however, at the foot of these hills nightly enter the fields in spite of the watchmen's shouts. It is a fact that two bulls often consort together, but my experience has been that in nearly every case one of the bulls has been an older and finer animal than the other. The younger one has always seemed to me to be rather more on the alert, and in many ways gives one the impression that he acts as his companion's "fag." During the breeding season they attach themselves to a herd and fight each other furiously. The author, writing on the sounds uttered by bison, says: "Bulls when breeding, and in the herd for that purpose, utter the most absurd piping or whistling sound, more like the call of a bird than anything else, and absurd by reason of it emanating from so large and powerful an animal''. I know the sound the author refers to well, and have frequently heard bulls utter it from November to February, but I should describe it rather as a sing-song humming or moaning sound, often, starting shrill and gradually lowering and deepening in note until it dies away. I once heard a solitary bull making a most extraordinary noise which I thought was being uttered by an elephant. On being assured by my Sholaga trackers that the sound emanated from a bull-bison we approached in the direction the sound was coming from and observed a solitary bull tramping steadily along and every now and then making a noise something akin to the prolonged trumpet of an elephant. The month was April so well out of the breeding season although my trackers informed me that it was calling for a mate. I am unable to account for its unusual behaviour. In discussing the method of shooting bison the author says: "One of the first difficulties the novice encounters is to distinguish bulls from cows''. I cannot agree with this: a good shootable bull stands head and shoulders higher than a cow: he is an immense animal with an enormous dorsal ridge, and coal black; and, unless the shootable bulls in the Central Indian jungles are very much smaller than those to be found in these parts, I cannot conceive how any mistake can possibly be made, the difference being so marked. The author goes on to say that frontal shots should be avoided, and that only solid bullets should be used. On both these points I disagree with him also: a well placed chest shot is very fatal, and there is nothing in my opinion against the sportsman using soft-nosed bullets (with high-velocity rifles) when shooting bison I do not consider that anything smaller than a·450 bore rifle should be used however. I speak from experience: I have shot a good many bison and have just as frequently been out with others after bison, and in every case soft-nosed bullets have been used with success. Referring to the colour of a bison's eyes the author writes: "I agree with Major Stockley in stating the iris to be brown: any blue that exists is confined to the cornea'': nevertheless the impression conveyed to one when observing a bison's eyes (whether living or dead) is that they are blue. This is due to the fact that the centre of the eye is blue, and rimmed with brown.

Tiger.—I am afraid I cannot agree with the author also, when he writes that the use of an electric lamp when sitting up over a kill for tiger oversteps the mark, that is to say if his remarks are meant to apply to the South Indian jungles as, well. Kills on these hills occur more often than not in dense jungle through which the brightest moonlight barely penetrates, and if the sportsman does not have the assistance of artificial light he might just as well not sit up at all. I have not found that "the tiger stands in stupid wonder gazing at what it no doubt considers some phenomenal star'': only on one occasion did a tiger give me an easy stationary shot on turning on the light—and I missed !! In the majority of cases the tiger, I have found, bounds away alarmed and a quick and often difficult shot has to be taken. Mr. Dunbar Brander's opinion on this matter may be the correct one in connection with the jungles he writes of, but not I think in regard to the South Indian hill jungles. Quite recently, a tiger never even gave me the slightest chance of getting in a shot, although it came to the kill three times the tiger was out of the area lit up by the light within a fraction of a second of the light being turned on each time.

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* There is an old record in the journal of a pair of Bison appearing on the rifle range at Kamptee, C. P., while musketry practice was in progress the exciting hunt that ensued resulted in one of the animals being done to death in Kamptee Bazar.—Eds.

Flying Squirrels.—Writing of the Flying Squirrel the author describes the ' booming" noise these animals make when they emerge from their holes after dark. He omits to mention however the Flying Squirrel's common call which somewhat resembles a long-drawn-out throaty cat's "me-ow" often ending in a deep " o-o-oom ". It is curious that the author has not included the Indian Pangolin (often miscalled the Armadillo) in his chapter on " Other jungle animals" : and this omission leads one to gather that this scaly little animal does not occur in the Central Indian Jungles, and I should like to know if this is so: It is extremely nocturnal, in 13 years I have only seen one in daylight; but they are fairly common in these jungles. I recently came on the remains of one that had been killed and eaten by a panther. The Badagas on the Nilgiris and on these hills prize the larger scales through which they bore a hole and wear them as rings. Their food consists of ants and insects and one comes across the small holes they scrape out in the jungle quite often.

RALPH C. MORRIS.

HONNAMETTI ESTATE,
ATTIKAN *via* MYSORE,
24th February 1925.

We append the following comments by Mr. A. Dunbar Brander on the above.

Sambar.—The sore patch on the necks of sambar is not common in the Central Provinces. There are many other parts of India where the phenomenon can be observed more frequently, giving more opportunity of discovering the cause. My remark in " Wild animals in Central India" is as follows—" occurring as they (the spots) do in the region of a hair whorl or centre I have associated the phenomenon as being in some way connected with the new growth of hair." It is obvious this is a mere theory: as much so as Mr. Morris' explanation is. Mr. Morris says he has only seen the sore on stags. Can he explain why the ring worm should confine itself to one sex *?

Chital.—Great numbers of your readers must have heard chital calling hundreds of times. Written language is a poor medium by which to convey sound. I much prefer my own description of the sound to Mr. Morris unless, that is to say, the Chital of Southern India makes a different call to those of Central India.

Muntjac.—Mr. Morris must give me the credit for having heard the noise referred to. Supporting the views that he does, it is surprising that he does not refer to the well known fact that the domestic sheep can and does click its toes or hoofs. In writing my book there was a simple explanation to offer, but there was no temptation to make use of it as I did not think the noise made by the Muntjac emanated from the feet and I had to say so. To have said otherwise, would have been to have abandoned my beliefs, because an obvious and handy explanation was forthcoming. Can Mr. Morris explain the pause between every third stroke if the noise is to be ascribed to the hoofs coming together at every bound ? And how is this accomplished on the very uneven ground they so constantly frequent often making anything in the nature of a rythmic action impossible.

Four-horned Antelope.—This animal is not gregarious in the Central Provinces. Mr. Morris refers to having seen 5 or 6 mature animals together " especially on one favourite hill top." Their association together might have been due to the attraction of " the favourite hill top " and not any desire of consorting with each other. The point is worth considering. I have seen African duikers and four-horned antelope on hundreds of occasions and I have never known them to be gregarious.

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* In Vol. XXVIII, p. 1125 of the Journal, Mr. R. A. H. McConnell records the shooting of a sambar hind with 'sore neck'.—Eds.

Bison.—It is very satisfactory to have confirmation of the very peculiar cry made by bulls when breeding as, so far as I know, I am the first author who has referred to this call. If Mr. Morris had had as much experience of enforcing the game laws as I have had he would know the ease with which a cow can be mistaken for a bull, one does not expect sportsmen with Mr. Morris' experience to make mistakes, but possibly 90 per cent. of the permit holders are novices. What frequently results in a cow being shot is the sportsman firing at what he *thinks* is the biggest animal—and it *often appears to be so.* Imagine a herd of bison grazing in a grass maidan, the grass 4 to 5 ft. high, a very common occurrence. The ground is uneven, there are slight depressions and eminences. A cow happens to be on some slight eminence concealed by grass and unknown to the sportsman. The bull may be in a depression, at any rate a cow on an eminence of even a foot seems to dominate the whole herd, is at once selected as the bull and downed. The advice was therefore tendered not to trust to *apparent bulk* for *identification,* and it is sound advice. It was never even hinted that the bull is not considerably larger than the cow, but in the Central Provinces the difference in size is not so marked as Mr. Morris' language would imply. There is often no difference, absolutely, in colour. I would always tender the advice to avoid frontal shots. This of course does not mean to say that a frontal shot is not to be taken if no other seems possible, but where a choice of angle is procurable avoid the frontal shot.

I absolutely join issue regarding the use of soft-nosed bullets from either a low or a high velocity rifle and, in point of fact, better results are often made by the former weapon with this class of projectile. The modern soft-nosed bullet fired from a high velocity rifle is often most unsatisfactory. They are apt to fly to pieces on hitting a large bone, especially so on a *surface* bone. The great point however about using solid bullets is that they will do everything to a beast like a bison that a soft-nosed bullet will, and in addition they will do a *great deal more.* Angle need not be considered to the same extent—the bullet will rake the beast. I once knocked down a bull which never rose again, with a solid hardened ·577 bullet fired into its tail as it went away : an impossible shot with a soft-nosed bullet. Soft-nosed bullets are often exceedingly cruel and wounded bison sometimes escape or are only killed after a long hunt.

Bison can be killed and often are, in a most satisfactory manner by soft-nosed bullets : they would have been equally well killed however by a bullet having more consistency and it is only a question of time in order to come across a case in which the soft-nosed bullet fails and one regrets not having used a harder and more consistent projectile. In the course of my experience I have dropped 3 bison in their tracks with a soft-nosed bullet fired from a Standard Mauser rifle and I fired no other shots at bison from this weapon, but I do not therefore recommend either the bullet or the weapon. I entirely agree with Mr. Morris' remarks about the bison's eye : it gives off a blue light as described by him. The blueness is not in dispute, its source is. I have never seen a bison with an eye which could be described as having a blue iris in the ordinary accepted sense of the term. There are a number of the best herd of Aberdeen Angus Cattle in the Spey Valley, they are readily accessible to me : they all have the typical bison's eye and can be studied at leisure.

Tiger.—It was never expected that my criticism of the electric lamp would have general acceptance ; all the same I have had a great deal of encouragement from perfect strangers. I only used the electric lamp as an experiment as long ago as 1905. I found that unless the tiger became aware of one by movement or noise in turning over the light they behaved as described. African observers have confirmed this behaviour with respect to other animals. Since 1905 the electric light has come into general use there are bound to be sophisticated tigers.

Flying Squirrels.—I expect Mr. Morris' description of the call and mine refer to the same noise as he ends up his attempt to reproduce the call with 0-0-00m. I made no attempt to reproduce the call but referred to it as a "booming" noise.

Pangolin.—A reference to this animal appeared to me to be outside the scope of the declared purpose of the chapter on "other animals:" as a matter of fact I drafted a page on it and then cut it out. It is rare and still more rarely seen. In some districts the jungle tribes know nothing of it. I found more evidence of it in the Seoni and Melaghat divisions than elsewhere. In the latter I met a fair number of old Korkus who had come across one, perhaps two, in their lives. I have only seen two myself. Jungle fires sometimes produce their shells. I daresay professional snake catchers might produce one, given a reasonable time, certainly no one else could and the animal is so outside the "Ken" and the "interest" of the average visitor to the Central Provinces I think was rightly omitted.

A. A. Dunbar Brander

Ivy Bank, Elgin,
Scotland, *March* 1925.

No. IV.—BLACK JACKAL.

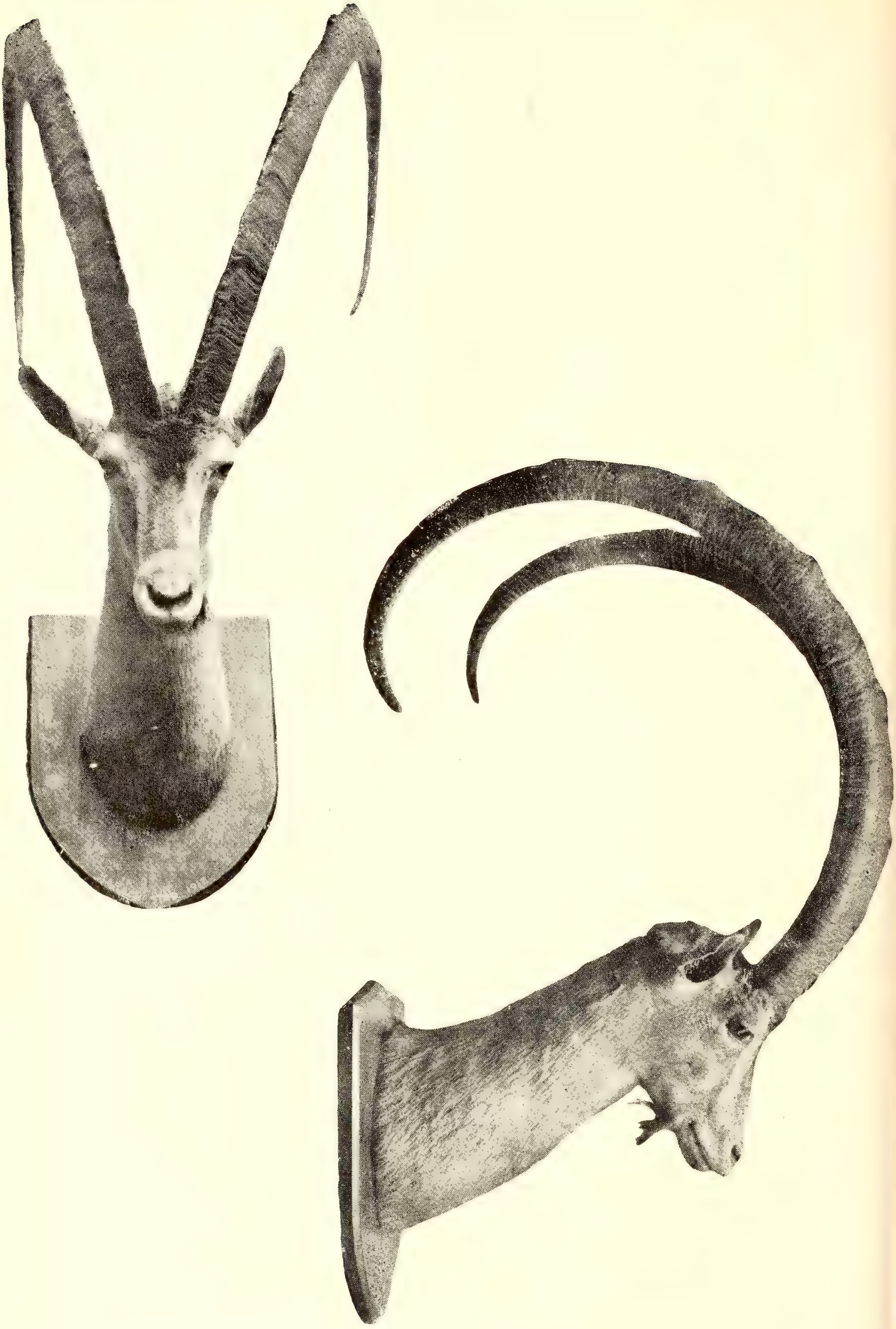
A black jackal was seen by me on the evening of the 19th April 1924, at about 5 p.m. near Shirali, a village, on the south border of the Kanara District, about 2 miles from the sea. I was in a motor car when it passed across the road in front of the car going towards the riverside. At first I thought it was a dog; but when I saw 2 or 3 other jackals of the ordinary colour following it and also when I observed its tail closely I suspected it was a jackal. It ran on stopping every little while to look behind—a thing which jackals usually do. I then wrote to Mr. T.R. Bell, C.I.E., and also to the Bombay Natural History Society and was told that they were not aware of the existence of a black jackal. I then tried to catch it alive. The usual haunt of this queer animal was found out. This was in a small woodland *within the village* in which there were some small rocky caves. The villagers told me that this jackal had been observed very often in the village, during the last two years. It used to go to the riverside for fishing. I sent down a big box-trap, fitted with a small compartment for the bait. Fowls and fish were daily put in as bait; but neither this jackal nor others would come near them. We next tried to catch it in a net by beating the jungles, but it eluded us. At last on the 1st of January it was luckily caught in a net along with a normal-coloured female jackal. Both were put into the box. It gave some trouble but the man boldly pushed it in. While with me for 2 or 3 days, I put live chickens inside the box for its food; but though the chickens walked over its body, its mouth, etc., it did not touch them during the day time, but at night it used to finish off everything that was put into its cage and drink water copiously.

There are some black dogs in the village and it is possible that the animal is a cross-breed, *i.e.* a hybrid dog-jackal.

M. S. TUGGERSE,
Divisional Forest Officer.

Kanara Coast Division,
Honavar, *8th February* 1925.

[The animal was forwarded to Bombay through Mr. T. R. Bell and is now in the local Zoo—there seems to be no doubt that it is a hybrid dog-jackal and not a melanistic form of the common jackal. The back and head of the animal are black. It has a brown spot above each eye, the chin and lips are white—the underparts creamy, and there is a certain amount of rufous on the legs. The tail is black and quite bushy. Interbreeding between



RECORD SIND WILD GOAT. (CAPRA HIRCUS BLYTHI.)
Length $52\frac{7}{16}$″, girth $7\frac{1}{2}$″.

domesticated dogs and cats with corresponding wild species undoubtedly occurs, though authenticated records are rare. Many of the tame village cats are very similar in colour and markings to the common wild cats, while the jackal-like appearance of many pariah dogs and the wolf-like appearance of others seems to indicate that cross-breeding does take place.

The origin of the domestic dog is still involved in mystery, some Naturalists believe it be a distinct species descended from one that no longer exists in wild state, others trace its ancestors to the wild or half wild races either of true dogs, wolves or jackals, while others believe it to be the result of mingling of two or more wild species or races. Blanford is of opinion that the common Indian pie-dogs may be in part descended from wolves, he adds however that they are probably chiefly derived from Jackals.—EDS.

No. V.—A RECORD SIND WILD GOAT.

(*CAPRA HIRCUS BLYTHI.*)

(*With a plate.*)

Early in November, 1912, I was again able to visit the Khirthar Range in Sind (for the third time) and on this occasion my camp, consisting of one small *raoti* for myself and one for my servants, was pitched half way up the hill, near a pool of clear water in the bottom of a ravine which had not then dried up. The local " shikaris", disdaining such comforts, were content with a camel hair blanket and a good fire at night. We started early in the morning, reaching the top of the hill before the sun rose and then working our way across a succession of rather steep ravines. About 9 o'clock we came on a heard of Ibex, slowly feeding their way upwards, with one quite good head amongst them ; but my chief " shikari "—a " Baluch " by caste and the best of stalkers—implored me not to shoot as the big head they had marked down a few days previously was probably not far off. So, skirting the herd with caution, we went on again and an hour later spotted another herd, which must have numbered at least 60, spread out on the opposite side of the ravine to where we were lying. Almost on a level with us, and well above the rest of the herd, a fidgety nanny was continually stamping and snorting, effectively preventing us from examining those animals which were down in the bed of the ravine. The " shikaris " however were convinced that this was the herd they were looking for as they had seen a big male with one horn among those visible, which they assured me belonged to the same herd as the big one. The animals had taken up their position for the day and, as they were not likely to move for some hours, we sat down for a bite and a rest, one of the party keeping an eye on the herd. About 3 o'clock the herd began to move and, led by the fidgety female, moved up and over the opposite side of the ravine at a slow walk. Those in the bed of the ravine got up one by one and followed the others. Amongst these were several big heads and each time one appeared I looked enquiringly at the head " shikari " but each time he shook his head. The last to appear was a big buck-goat with very curly horns and I proceeded to get my sights on to him, making sure that he was *the* big one. A sharp hiss and a violent shake of the head from the " shikari " stopped me and I again watched. After a perceptible interval, when I was beginning to think that the big head only existed in the " shakari's " imagination, an Ibex suddenly got up from behind a bush and stood for a minute looking alternately down the valley and towards the rest of the herd, the last of whom must have been 100 yards away from him.

I then saw that the " shikari " had spoken the truth, as although in actual body he was on the small side his horns looked enormous. He took some time to make up his mind to follow the others, and it was probably owing to this habit of his of hanging behind that he had escaped so long. Finally he moved up slowly after the herd, giving me a crossing shot at about 200 yards. What with the excitement of watching for so long, and the actual sight of the big Ibex, I was none too steady as my first shot was too high and, as I afterwards discovered, did little damage. He stood perfectly still at the shot, puzzled as to where it had come from. While he was still thinking a second bullet caught him behind the shoulder and he rolled down the ravine about 30 yards, finally getting caught in a bush where he hung by his horns. In this position his throat was cut by a wildly excited " shikari " who fled down the hill regardless of his neck in order to get him before the last breath was out of his body. Meanwhile I, on the top of the ravine, was thumping the head " shikari " on the back in honour of the occasion. Two days later I got the curly-horned buck out of the same herd. His horns were 46½″. We took the big Ibex back to camp in triumph and I measured him next morning.

The following are the measurements recorded by me :—

Right Horn	$52\frac{7}{16}$ (Broken tip).
Left Horn	51½
Girth	7½

The right horn measured 52¾″ when the animal was shot, the subsequent reduction being due to shrinkage.

The above measurements have been verified by Major W. B. Trevenen, at Poona. I enclose two photographs of the head in question.

I may add that I have shot many animals of the species between the years 1910-1918. The following measurements of heads in my possession shows the average size of a really good head of the Wild Goat in Sind.

One head of 47¾″, one head 46½″, 6 heads 45″ and one head 42½″. All shot in the Khirthar Range and in my possession at present.

" Ryecotes," Yeravda, R. L. McCULLOCH.
Poona, *February 9th*, 1925.

[There is a head of a Sind Wild Goat in the British Museum measuring 52⅜″ × 7⅞″ shot by Col. F. Marston—Eds.]

No. VI.—THE ALLIED GROSBEAK (*PERRISOSPIZA AFFINIS* Blyth.)

This grosbeak was originally described by Blyth (J.A.S.B. xxiv. 179, 1855) From the ' Alpine Punjab,' but in spite of this fact, and Jerdon's further statement (B.I. ii. 385) that " It has only hitherto been sent from the extreme north-west, *viz.*, the Alpine Punjab", doubt has persistently been thrown on the authenticity of the specimen in the Pinwell collection (British Museum) labelled Dharmsala.

The following remarks by Surg.-General L. C. Stewart (Zoologist, 1886. p. 290) however settle the question of typel ocality, which should be restricted to Hazara. He says " On looking over a collection of birds belonging to Major Blagrave of the Trigonometrical Survey, I found some examples of a large rosbeak which seemed different from any of the above-named and which had been shot in the hills beyond Murree in the far north-west. On sending them to Calcutta they were pronounced new and named by Blyth *Coccothraustes affinis*."

The Dharmsala locality has now been confirmed by my obtaining a male from a pair which were evidently breeding in the Kharshu Oak (*Quercus semicarpifoliata*) forest about the Kareri Lake 10,000, just west of Dharmsala.

The species is widely distributed and locally common in Central and Upper Gahrwal (Jour. B. N. H. S., xxviii, 151) and therefore clearly extends throughout the whole of the Western Himalayas. In view therefore of the coincidence in the ranges of *Perrisospiza icteroides and P. affinis* they must be treated as separate species and not as races of one bird.

BATTLE, SUSSEX, HUGH WHISTLER, F.Z.S.,
26th November 1924. *Indian Police.*

No. VII.—ON THE BREEDING OF THE INDIAN TREE PIPIT (*ANTHUS HODGSONI*) IN KULU.

This Pipit has long been known to breed in Kulu, as one of the first recorded eggs was received by Hume from the snowy range bordering on Spiti in Upper Kulu where it was taken on 3rd June (N. and E., 2nd ed., II, 209). There are however few accounts on record of the nidification of this bird so it may be of interest to relate the following experience.

On 16th June 1922 I stole a day from my official duties in order to visit the far-famed and beautiful Jalouri Pass (10,500′) which carries the trade road from Inner to Outer Saraj in Lower Kulu. Many interesting birds were found to be breeding in the forests that clothe the Jalouri ridge, and these delayed and entertained my ascent of the Pass.

As soon however as we climbed on to the open ground of the ridge to the east of the actual Pass we met with the males of the Indian Tree Pipit which were all in song. There were a number about and they kept on flying into the air for a short distance and then volplaning down to the ground or the topmost twig of an oak, with wings and tail outspread, singing loudly all the while. The song was lark-like in character, rather than the usual wheezy characteristic song of the Pipits. The back of the ridge was here very open and bare, save for a short crop of grass dotted with anemones, and a search failed to reveal any nests: it is possible that the nests belonging to these males were in the oak woods that clothed the slopes on both sides, though I hardly believe so.

We then proceeded further along the bare and narrow ridge; the northern slope was free of forest for some distance below the summit doubtless owing to the cold winds that swept continuously up from the valley, though here and there thickets of rhododendron and other bushes withstood its force. The southern slopes, which face towards Simla, were, however, covered with an unbroken forest of Kharshu Oak (*Quercus semicarpifoliata*) which stretched up to within a few yards of the top of the ridge; here it left a small area, warm and sheltered in the sunlight, and covered with large patches of *Cotoneaster microphylla*; this is a curious evergreen creeping shrub, with thick wooden stems and tiny round leaves and flowers, which forms a dense rough carpet on the ground. This sheltered portion of the ridge proved to be the nesting ground of the Pipit and here four nests were soon discovered in less than quarter of a mile, though no males were observed in this area, nor was their song heard.

The first nest was found by my orderly in the course of a general search. It contained 4 eggs nearly ready to hatch, though the bird was not present at the moment of discovery. However when we returned later to the spot I flushed her from the nest and she flew up into an oak tree where I shot her.

The site of this nest was typical of all that we saw, it was placed in a hollow of the ground under the interlacing stems of the *Cotoneaster*, being almost concealed by them from sight and very difficult to discover in consequence.

A second nest with 4 fresh eggs was revealed by the bird which flew off just in front of us as we slowly searched another patch of *Cotoneaster*; each time this bird was flushed she flew up into the oaks at the edge of the forest.

A third nest found in the course of our search contained three slightly incubated eggs, one of which was damaged. It was deserted, and doubtless the sitting bird had been attacked by some enemy, possibly a snake as there were some about.

The fourth nest was again revealed by the bird leaving it in front of us. She however did not fly up into the oaks, but each time fluttered along the ground into a patch of scrub and so on down the steep hill side, with the action characteristic of most hill-breeding Pipits.

The last three nests were similar in construction, a mass of moss and dry grass with a well constructed cup of fine dry grass stems lined with a few hairs. The first nest differed slightly in that there was practically no moss in the foundations, and there was a thick lining of the curious spine-like hairs of the musk-deer.

Next day I found one egg in a deserted nest which was littered with a few feathers as if the bird had been caught on it. This nest was rather wider and lined with coarse grass, and the situation was more open at the foot of a clump of growing bracken. It was on the northern slope of the hill, 500 feet lower than the other nests, and in a more open situation further from the oak forest.

The eggs obtained were all typical in colour and size.

BATTLE, SUSSEX, HUGH WHISTLER, F.L.S., F.Z.S.,

31*st December* 1924. *Indian Police.*

No. VIII.—THE COTTON TEAL.

You may be interested to hear that on the 28th August this year a cotton teal's nest was discovered in a box-like hole at the end of a coping on the roof of Government House, Rangoon, 68 feet from the ground. There were 13 young birds which had apparently been pushed out by the mother and fallen to the ground, some of them hitting some telephone wires about 15 feet from the ground. A servant, who saw some of them falling, was emphatic that they fell like a stone for a long distance and then fluttered and broke the fall as they approached the ground. He did not see any of them being carried down by the mother in her feet. The mother and the whole brood were caught, but in the night the mother escaped and all efforts to save the young birds by artificial feeding failed.

GOVERNOR'S CAMP,
BURMA,
25*th August* 1924. HARCOURT BUTLER.

[The lofty situation of the nest above the ground is remarkable. Stuart Baker (*vide* Indian Ducks, etc.) could not recall from his observations any that were above 15 or 16 feet from the ground. He mentions Oates' record of a nest on a mango tree 30 feet from the ground and quotes Cripps who says that the birds even ' laid their eggs in the factory chimneys." The method by which the newly hatched goslets are brought to the ground, as reported by Sir Harcourt Butler throws fresh light on the nesting habits of the species.—EDS.]

No. IX.—OCCURRENCE OF THE SCAUP DUCK (*FULIGULA MARILLA*) IN NORTHERN INDIA.

An example of the Scaup duck (*Nyroca marilla*) was sent to the Society by Mr. G. J. Monahan, I.C.S. It was shot in the north of the Monghyr District, Bengal, on the 31st December 1924. The Scaup is a duck of very northern latitudes " breeding in the Palaeartic and Nearctic regions in the extreme north of Europe, Asia and America up to, if not beyond, north-east latitude 70°, in Asia." It is described as a very rare winter visitor to India. A second example, a female, was forwarded by Mr. J. C. Higgins. The bird was shot at Ipop, 15 miles south of Imphal, Manipur. The taking of this duck in the Monghyr District and in Manipur adds to the existing records of its very occasional occurrence in India.

BOMBAY NATURAL HISTORY SOCIETY, S. H. PRATER, C.M.Z.S.
5th March 1925.

No. X.—THE LENGTH ATTAINED BY AND THE HABITS OF THE GAHRIAL (*G. GANGETICUS*).

In reply to an article I recently wrote for Blackwood's Magazine on the subject of " Crocodiles "—a correspondent (whom I have never met) has sent me a letter in which he states that the biggest Gahrials he shot were in the Gogra at Fyzabad in 1920—which attained a length of 21′-6″ in one case—and between 18′ and 19′ in the other. I would invite correspondence on this subject, and request information of authentic instances of Gahrial attaining a greater length.

My correspondent also stated that the largest specimen which was killed during August 1920, contained " besides pounds weight of native glass and metal ornaments, the entire hind-quarters of a dhobi's donkey".

It is quite probable that I am completely at fault but I was always under the impression that gahrial lived exclusively on fish—and I also believed that the formation of its throat, precluded any possibility of its swallowing such huge morsels as a donkey's hind quarters, or portion of human beings and corpses. I request enlightenment on this point.

KENYA COLONY, EAST AFRICA, C. R. S. PITMAN,
31st October 1924. Major.

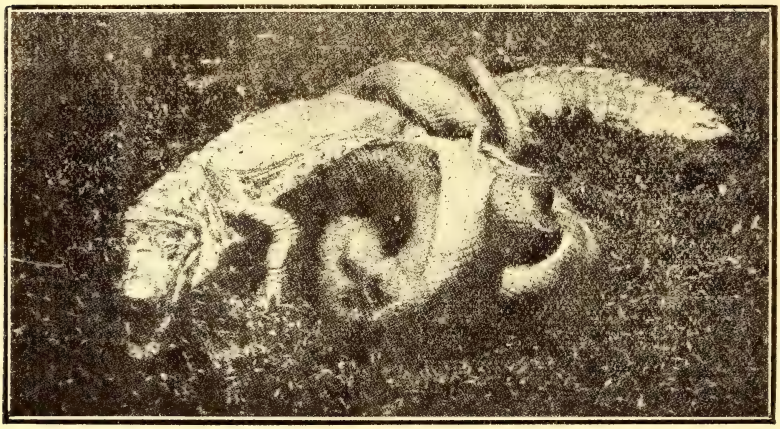
[Bangles and other human ornaments are found quite often in the stomach of the Gahrial—the name Gahrial by the way is said to be derived from the likeness of the large knob or, protuberance, seen on the snouts of old males to a *gahra* or earthen pot used by the natives of N. India. These finds are generally regarded as evidence of the reptiles having dined off a carcase. The slenderness of the jaws and the fineness of the teeth, compared with those of the mugger, are believed to restrict the gahrial to the capture of fish and smaller prey and to prevent its attacking larger quarry—but there is nothing in the structure of the reptile to prevent it from swallowing quite large mouthfuls, as has been indicated in the present instance. The stomach of a crocodile is small but this does not prevent him from making a large meal, as a great portion of the food is first stowed away in a capacious gullet. Stones are frequently found within the stomach, these are usually malodorous and bear evidence of having been in the stomach for some time. They are presumably swallowed as an aid to digestion, in the same manner as a bird stocks its gizzard with grit and sand.

The largest of the 3 Indian Crocodiles is the Estuary Crocodile (*C. porosus*) of the East Coast, the Sunderbunds, Ceylon and the back-waters of Travancore —a specimen 33 feet long is on record—but doubts have been cast on the correctness of this measurement. Readers of this Journal will probably be able to furnish authentic measurements of large mugger, gahrial, and estuary crocodiles shot by them.—EDS.]

No. XI.—BOA CONSTRICTOR *vs.* ALLIGATOR.

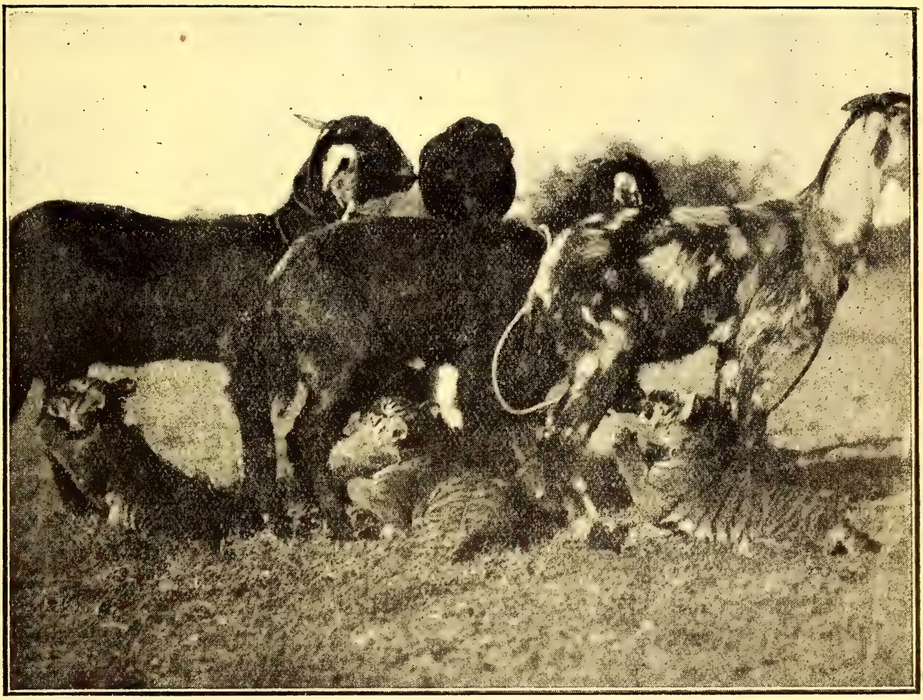
(*With a Block.*)

With reference to Mr. Coleridge Beadon's note on a python swallowing a monitor on page 229 of this volume, we publish the accompanying photo of an alligator killed by a Boa Constrictor on the River Masparito, Venezuela. The alligator was 10 feet long and the snake about 20 feet. The photo was sent by Mr. Sydney P. Mortimer, Mariacarbo, Venezuela, to "*Overseas*", the monthly Journal of the Overseas League. The largest of the South American Boas is the Anaconda (*Eunectis murinus*) ; which is stated to commonly reach a length of 33 feet. Our reticulated Python (*P. reticulatus*) of Burma and the Malay countries runs it very close with 30 feet. The true Boas, as distinguished from the Pythons, are common to the hotter regions of South America and Madagascar—the only true Boas (*Boinæ*) which occur within Indian limits are the small Black Earth Boa (*Eryx jaculus*) and the Red Earth Boa (*Eryx conicus*).



[EDITORS.]

No. XII.—TIGER KILLED BY A COBRA.



Strange Foster parents!

The following is an account of a tigress which died as a result of its being bitten by a cobra in the Jamnagar Zoo, Kathiawar. A correspondent reporting the case in the *Times of India* writes as follows:—

" An incident which is probably unprecedented in the case of animals in captivity occurred recently in the Zoological Gardens at Jamnagar. Among the fine specimens, kept there by His Highness the Jam Saheb, was a tigress with three cubs. On going his rounds early one morning the keeper was not a little surprised to find the tigress stark and stiff. Immediate search for the cause of this sudden demise : on the part of what had been overnight a thoroughly healthy animal, revealed a cobra sleeping peacefully coiled up in a corner of the cage. A gun speedily did the needful despatch. On examination the tigress was found to have been bitten in the cheek. The three cubs were all very much alive and well. How they failed to attract a bite is " wrapt in mystery ". Or perhaps the cobra, having expended its venom on the tigress, may have bitten one and proved harmless. However, no mark of such a bite could be traced, and the three cubs are now as lively as crickets, the cynosure of many curious and admiring eyes. His Highness' guests are often at the Zoo handling these playful little beasts and watching them at feeding time. In this function a trio of sturdy goats plays an important and, it must be said, extraordinarily complaisant part. The foster mothers play the game in most sporting fashion and very seldom attempt to butt their sturdy " offspring." Doubtless the time is not far distant when sharper claws and teeth will bring a change on the scene, but at present the trio of *budmashes* is thriving apace and looking very well upon its enforced diet."

The following extract from the report of the Veterinary Surgeon in charge of the Zoo was forwarded to us by the Private Secretary to H. H. the Maharaja of Jamnagar.

" The tigress *Sunder* was alright on the 9th December. Next morning when the keeper of the animals went to see them as usual, he found the tigress dead. He informed me, whereupon I went there. The tigress was taken out of the cage. On an examination it was found that she was bitten on the lower jaw just below the angle of the mouth on the left side. The part bitten was swollen and there was hæmorrhage from the nostrils and from the rectum. On a post-mortem examination it was found that all the organs inside were little or more congested and blood was found coagulated on exposure to atmosphere, *i.e.*, after removal from the blood vessels."

" The tigress left three cubs—two females and one male about a month old. For their nourishment she-goats are kept and they are suckling them. The cubs are quite well and in good condition. The incident occurred during the night."

We are indebted to the Editor of the *Times of India* for permission to publish the interesting photo reproduced above.

[EDITORS.]

No. XIII.—RECORD OF A DEATH FROM BITE OF THE HAMADRYAD OR KING COBRA (*NAIA HANNA*).

In your Journal, Vol. XXX, No. 1, 1st October 1924, on page No. 194, in the paper by Col. F. Wall, I.M.S., read before the B.N.H.S.'s meeting held on 22nd July 1924, it says :—

" I know of no case of a bite in a European."

About 10 or 12 years ago, Mr. Slater of the Geological Dept. of the Mysore Service was bitten by a King Cobra.

This happened at Hoonsakoltti, near Thirthally, in the Shimoga District, Mysore State, S. India.

The Forest Ranger informed me that Slater and a cooly were going out one morning with a 12 Bore gun. Close to the Traveller's Bungalow they saw the snake lying sunning itself. The cooly begged of Slater to shoot it. But Slater was keen on snakes, and finding that the Hamadryad was lying quiet went up and put his foot on its head. He was wearing long boots or leather leggings. But the snake managed to wrench its head loose and struck Slater above the knee, and escaped.

Slater cut the wounds and sucked the blood, and put ligatures, etc. The nearest doctor was sent for and everything possible was done. But Slater died in the evening.

The Thirthally jungles are noted for Hamadryads and local people hold it in great dread.

MYSORE, S. INDIA,
4th December 1924.

CHARLES THEOBALD, F.Z.S.

No. XIV.—RECOVERY FROM THE BITE OF *ECHIS CARINATA*.

The subject bitten was an Indian woman aged about forty years. The snake attached itself to her bare ankle and was killed by her husband, who was accompanying her.

She was seen by me five minutes later.

The snake was recognised to be an *Echis carinata.*

SYMPTOMS.—Very severe pain in the right foot at the seat of the injury. Pain running up the inner side of the leg. Vomiting. No symptoms of fear exhibited. Pulse normal.

Examination showed the foot to be swollen. There was a small raised patch immediately below the right internal malleolus. On the summit of this there were two small punctures from which there was a slight discharge of blood-stained serum.

TREATMENT.—A rubber torniquet was immediately applied below the knee. A local anæsthetic was injected into the surrounding tissues and a large crucial incision was made over the bite. The four resulting triangular flaps were dissected back. As much blood as possible was squeezed from the wound and then Potassium Permanganate crystals were well rubbed in. Calcium Chloride grs. 20 were given by the mouth.

The tourniquet caused so much pain that it had to be removed after three hours. Following this there was a moderate amount of bleeding which was checked by tight bandaging. The patient had a sleepless night owing to the pain. She was given Calcium Chloride grs. 15 t.i.d. and kept in a recumbent position.

From this on, her recovery was uneventful. She was allowed to sit up on the fourth day. Her wound healed by the eighth day. She is now quite well.

STATION HOSPITAL, H. J. RICE,
SATARA, *Capt.*, I.M.S.
27th September 1924.

No. XV.—VIPER AND WHITE-THROAT.

On the 23rd July while looking for Birds' nests on a hill-side at about 6,000 feet altitude near Pari Mahal (Srinagar-Kashmir), I came across a White-throat's nest (*Sylvia curruca affinis*) in a low thorny bush, about 2 feet from the ground. To my surprise I saw the nest was occupied by a small snake.

I despatched the snake which was a viper, dark greyish brown in colour and 16 inches in length.

The viper had a marked bulge in its body which on dissection was found to be caused by the mother white-throat's body which had evidently been swallowed quite recently. The nest was empty, but the eggs or young had probably been disposed of by the snake before tackling the parent bird though I could not detect them in the snake's internal economy. This Viper is, I think, somewhat rare in Kashmir though the Pit Viper (*Ancistrodon himalayense*) is very common. This latter snake does not however climb bushes.

Srinagar, B. B. OSMASTON,
Kashmir. I. F. S. (*retired*).

[The viper referred to is possibly the Levantine viper (*Vipera lebetina.*) —EDS.]

No. XVI.—A LIST OF FISH OBTAINED IN THE SARAN DISTRICT, BEHAR, CHIEFLY FROM THE GHOGRA RIVER NEAR THE TOWN OF CHAPRA AND IN ITS VICINITY.

This collection was made many years ago during a period of about a year. Only a few of the smaller species were preserved in spirit but drawings to scale were made of most of the larger ones after they had been identified. Although the list shows some sixty species, more would have been added if observations had been prolonged over a longer period. Several common forms are not recorded and Elasmobranchs, in the form of Rays, are certainly found, for they are very common in the Ganges and even ascend the Jumna and it is at Chapra that the Ghogra joins the Ganges.

Some of these records are, nevertheless, interesting especially those of *Ophichthys boro* and of the Pipe Fish *Doryichthys cuncalus*. Local vernacular names of the fishes are given and in most cases the date and locality in which each specimen was taken. I have used for the species the nomenclature of Day in the Fish volumes of the Fauna of British India and have given his numbers after the serial number.

Order TELEOSTEI.

Suborder *MALACOPTERYGI.*

Family Ntopteridæ.

1.	519.	*Notopterus kapirat*, Pallas. Common. R. Ghogra Darauli, 3-10-06.	*Golai Moi.*
2.	520.	*Notopterus chitala*, H.B. Chapra, R. Ghogra, 8-10-06 Common	*Moi.*

Family *Clupeidæ.*

3.	469.	*Clupea chapra*, H. B. Ghogra R. 20-10-06.	*Suaia.*
4.	470.	*Clupea ilisha*, H. B. Plentiful during the monsoon	*Hilsa.*
5.	498.	*Eugraulis tilara*, H. B. Ghogra R. 21-9-06.	*Phussia.*

Suborder *OSTARIOPHYSI.*

Family Cyprinidæ.

Subfamily *Cyprininæ.*

6.	295.	*Labeo gonius*, H. B. Ghogra R. 3-10-06 ..	*Kursa.*
7.	297.	*Labeo rohita*, H. B. Ghogra R. 30-8-06. Very common	*Rahu.*
8.	321.	*Cirrhina mrigala*, H. B. Ghogra R. 30-7-06.	*Nainee.*
9.	322.	*Cirrhina latia*, H. B. Ghogra R. 4-10-06 ..	*Rewa.*
10.	323.	*Cirrhina reba*, H. B. Ghogra R. 30-10-06..	*Bunsa.*
11.	332.	*Catla buchanani*, Cuv and Val Ghogra R. 25-10-06	*Cutla.*
12.	341.	*Barbus sarana*, H. B.	*Durhee.*
13.	375.	*Barbus parrah*, Day. Telpa, Ghogra R. 4-10-06	*Phurrah.*
14.	391.	*Barbus stoliczkanus*, Day	*Hurda.*
15.	398.	*Barbus stigma*, Cuv and Val. Chapra, Ghogra R. 22-10-06. Very common ..	*Pottiah.*
16.	399.	*Barbus crysopternus*, McClell	*Pottiah.*
17.	409.	*Nuria danrica*, H. B. Common	*Dahwiee.*
18.	411.	*Rasbora daniconius*, H. B. Common.	
19.	417.	*Rohtee cotio*, H. B. Chiran, Ghogra R. 14-10-06	*Gurda.*
20.	435.	*Barilus bola*, H. B. Chapra, Ghogra R. 17-10-06	*Girgittee.*
21.	449.	*Chela gora*, H. B. Chapra, Ghogra R. 2-10-06. Very common. Subfamily *Cobitidinæ.*	*Chelhua.*
22.	230.	*Botiadario*, H. B. Jelalpur, R. Ghogra 14-1-07	*Baghwa.*
23.	231.	*Botia gelo*, H. B. Jelalpur, Ghogra R. 14-1-07	*Baghwa.*
24.	237.	*Lepidocephalichthys guntea*, H. B. Chapra.	
25.	247.	*Nemachilus botius*, H. B. Chapra, Ghogra R. 9-1-07	*Nuktee.*

Family SILURIDÆ.

Subfamily *Clariinæ.*

26.	121.	*Clarias magur*, H. B.	*Mangri.*

Subfamily *Silurinæ.*

27.	131.	*Amblyceps mangois*, H. B. Chapra, Ghogra R. 20-11-07	*Banguri.*
28.	132.	*Saccobranchus fossilis*, Bloch. Ghegta, Ghogra R. Common..	*Singhee.*
29.	134.	*Wallago attu*, Bl. Schn. Khanua nulla, Ghogra R.	*Boyari.*
30.	135.	*Eutropiichthys vacha*, H. B. Chapra, Ghogra R. 2-10-06. Common	*Pias.*
31.	138.	*Callichrous bimaculatus*, Bloch. Chapra, Ghogra R. 27-9-06. Very common ..	*Ghuktee.*
32.	143.	*Ailia coila*, H. B. Indaie, Ghogra R. 30-9-06	*Suthree.*
33.	148.	*Pseudeutropius murius*, H. B. Ghegta, Ghogra R. 14-10-06. Common	*Bachua.*
34.	151.	*Pseudeutropius garua*, H. B. Chapra, Ghogra R. 22-9-06. Very common	*Ghorua Bachua.*
35.	154.	*Silundia gangetica*, Cuv, and Val. Very common	*Silond.*

Subfamily *Bagrinæ.*

36.	156.	*Macrones aor*, H. B. Chapra Ghogra R. 13-9-06. Very common	*Tangra.*
37.	163.	*Macrones cavasius*, H. B. Chapra, Ghogra R. 27-9-06. Very common	*Susna Tangra.*
38.	164.	*Macrones tengara*, H. B. Telpa, Ghogra R. 19-10-06. Very common	*Pulwa Tengra.*
39.	175.	*Rita buchanani*, Bleeker, Chapra, Ghogra R. 6-10-06 Common	*Reta.*

Subfamily *Doradinæ.*

40.	112.	*Sisor rhabdophorus*, H. B. Chapra, Ghogra R. Not common. Only observed once.. ..	*Chennuah.*
41.	207.	*Bagarius yarrellii* H. B. Revelgung, Ghogra R. 20-9-06. Common	*Goshta.*
42.	218.	*Erethistes hara*, H. B. Chapra, Tel nulla, Ghogra R. 30-10-06.	
43.	228.	*Nangra viridescens*, H. B. Ghagta, Ghogra R. 14-10-06	*Nunra Tangra.*

Sub order *APODES.*

Family ANGUILLIDÆ.

44.	95.	*Anguilla bengalensis*, Grey and Hardw. Bam. Not common, but taken now and then.	
45.	105.	*Ophichthys boro*, H. B. Chapra, Ghogra R. ..	

Sub order *CATOSTEOMI.*

Family SYNGNATHIDÆ.

46.	1361.	*Doryichthys cuncalus*, H. B. Ghogra R.	

Sub order *PERCESOCES.*

Family Scombresocidæ.

47. 536. *Belone cancila*, H. B., Chapra, Ghogra R. 21-9-06. Very common .. .. .. *Kowal.*

Family Mugilidæ.

48. 1182. *Mugil corsula*, H. B. Ghogra R. Very common .. .. *Arwari.*

Family Ophiocephalidæ.

49. 1205, *Ophiocephalus gachua*, H. B. Revilgung, Ghogra R. 5-1-07. Common .. .. .. *Charna.*

50. 1203. *Ophiocephalus striatus* .. .. .. *Gurrai.*

51. 1206. *Ophiocephalus punctatus*, Bloch., Tank, Chapra, 1-10-06. Common .. .. *Ghurrai.*

Sub order *ACANTHOPTERYGII.*

Division PERCIFORMES.

Family Nandidæ.

52. 827. *Nandus marmoratus*, Cuv, and Val. Newajitola, Ghogra R. 30-10-06 .. *Dhalo.*

The specimen figured is rather pale and devoid of all marblings on the body but some are present on the head and there is a dark spot on the free portion of the tail.

Family Serranidæ.

Subfamily *Ambassinœ.*

53. 628. *Ambassis nama*, H. B. Chapra, Ghogra R. 27-10-06. Very common .. .. .. *Tikulia.*

54. 629. *Ambassis ranga*, H. B. Very common .. *Tikulia.*

Family Sciænidæ.

55. 868. *Sciœna coitor*, H. B. Ghogra R. 30-9-06 .. *Puthree.*

Family Osphromenidæ.

56. 1215. *Trichogaster lalius*, H. B. Kuthrie, Chapra, Ghogra R. 17-10-06. Very common. *Dhal.*

Division GOBIFORMES.

Family Gobidæ.

57. 1093. *Eleotris, fusca*, Bl. Schn, Bulla. Chapra, Ghogra R. 16-10-06. .. .. ..

Sub order *OPISTHOMI.*

Family Mastacembelidæ.

58. 1155. *Rhynchobdella aculeata*, Bloch., Chapra, Ghogra R. 25-9-06 .. .. *Gaichee.*

59. 1159. *Mastacembelus armatus*, Lacep. Chapra, Ghogra R. 29-9-06 .. .. *Bamie.*

Sub order *PLECTOGNATHI.*

Family GYMNODONTES.

60. 1406. *Tetrodon cutcutia*, H. B., Newajitola, Ghogra, R. 16-9-06 .. .. *Dathkirwa.*

E. A. D'ABREU,
Curator,
Nagpur Museum.

No. XVII.—THE OCCURRENCE OF THE SPINY-EEL (*RHYNCHOBDELLA ACULEATA* BLOCH), IN THE CENTRAL PROVINCES AND EXTENSION OF ITS HABITAT.

The distribution given by Day for this fish in India is limited to the brackish waters within tidal influence in the deltas of the larger rivers.

It really ascends the rivers to a far greater distance, and will probably prove to have a much wider range even in fresh-water tanks far from tidal-influence. It is common in the Ganges at least as far as Patna and Chapra and is even found in the Ghogra. In Behar, it is well known and has a distinct vernacular name '*Gaichee*'; differentiating it from *Bamie* and *Bam,* the terms applied to *Mastacembelus armatus* and other eels. I was not a little surprised when I found I had taken two specimens from an inland tank at Nagbhir in the North of the Chanda district in these provinces.

Other spiny-eels found locally are *M. armatus* and *M. pancalus.* The former may easily be recognised by its continuous dorsal, caudal, and anal fins. *R. aculeata* resembles *M. pancalus* in having the caudal fin disconnected with the dorsal and anal, but may be distinguished by having the snout transversely striate below and by the ocelli on the dorsal fin. The only other known Indian representative of this genus is *R. dhanashorii,* Hora, described in the Records of the Indian Museum, Vol. XXII, p. 205, from a single individual obtained in Dhanashori stream, about a mile from Dimapur, Assam. It was also taken far inland and in fresh water. This species differs from *R. aculeata* in having a characteristic colouration quite unlike *aculeata.* It is dull olivaceous with pale lines extending downwards and forwards from the base of the dorsal fin and becoming obscure in the belly region. Behind the vent these lines are joined together in an irregular manner to form a reticulation. A pale longitudinal band extends backwards from behind the eye and becomes obscure in the post anal region. The lower surface is pale, speckled with black on the lower surface of the head. The fins are dark, minutely banded and speckled with dull white; there are no ocelli on the dorsal fin. Its proportions are also different and the caudal and pectoral rays are 16 and 17 respectively, while in *aculeata* they are 15 and 23.

E. A. D'ABREU, F.Z.S.

CENTRAL MUSEUM,
NAGPUR, C. P.,

8th November 1924.

No. XVIII.—FORMULA FOR ESTIMATING WEIGHT OF MAHSEER.

For several years past I have always made it a practice to carefully measure my fish in addition to weighing them, and, with a very few exceptions, have not been satisfied that the most generally recognised formula for estimating their weight from the measurements is as correct as it might be, at any rate when applied to Lake Mahseer, such as are caught in Lake Fife, Khadakwasla, near Poona.

The earliest reference to any formula for this purpose is so far as I am aware, that referred to on page 74 of 'The Angler's Handbook' by G. H. Lacey and Dr. E. Cretin, and is, I think, the one most generally accepted, reading as follows *:—*

" First take the length and girth of the fish in inches; add " together the length, and one-third of the length; multiply the result by the square of the girth,and divide by 1,000, and the result will be the weight of the fish in pounds."

This formula may briefly be written down thus:—

$$\frac{(L + \frac{1}{3}L) \times (G)}{1000} = W$$

The author states that he has tried this formula with fish of all sizes up to 61 lbs., and found it approximately correct, *i.e.*, within 2 lbs. of actual weight in all fish up to 50 lbs., the tendency being to be a little in excess of *actual* weight. He further goes on to describe how the measurements should be taken:—" The length for this calculation is taken from the mouth (closed) to the *end* of the tail, and the girth is that of the thickest part of the fish's body........the tail should not be closed when measuring for the data for this calculation. It should be expanded or stretched to its full extent as if the fish was swimming."

Another formula is given on page 139 of the same edition under the heading ' Weighing Giant Fish.':—" Take the length of the fish *in feet*, leaving out the tail; cube the number thus got, the product will be the weight in pounds, *i.e.*, Weight = (length in feet) 3."

This is obviously a much too rough and ready rule to apply to smaller fish weighing from twenty to thirty pounds, and, as Thomas points out on page 37 of ' The Rod in India' (third edition), entirely ignores the question of girth which obviously must be taken into consideration in order to arrive at any approximately correct result. As regards this omission of girth the latter author goes on to say:—" This omission......is met by a kindly correspondent writing to me that he has found the following pretty correct:—' Take' he says, 'the length and girth in inches. Add together, and divide by two. This gives the weight in pounds pretty near.' "

As Thomas then proceeds to point out, however, this formula cannot possibly be applied to small fish. His remarks are as follows:—" Possibly it does when fish run over a certain weight, say ten or fifteen pounds, but it must be surely very much out when they are smaller. For instance a masheer of twelve inches long, without adding anything for girth, can never weigh six pounds." Even for larger fish I found this formula hopelessly inaccurate as the following two instances taken at random from my records of weights and measurements will show—

A ten pound fish measured 30″ in length and 17″ in girth.
A 15 lbs. fish ,, 33½″ ,, ,, 19½″ ,,

According to the above formula the former should weigh 23½ lbs. and the latter 27 lbs., the error in one case amounting to 13½ lbs. and to 12 lbs. in the other, which results speak for themselves.

' Skene Dhu ' in referring to the first of the three formulae mentioned above states on page 193 of 'The Mighty Mahseer' that it is generally fairly accurate with mahseer. He does not however state how the length of the fish is to be taken, so presumably his method of measurement is the same as previously quoted.

The above are the only three formulae with which I am acquainted and, for reasons shown above, we need only concern ourselves with the first when dealing with mahseer, this being:—

$$\frac{(L + \frac{1}{3}L) \times (G)^2}{1000} = W$$

where L is the extreme length in inches when the tail is opened and G the girth, W being the weight in pounds.

I will in future refer to this formula as ‘ A.’

I have now very carefully measured forty fish of all sizes ranging from 2 lbs. to 21½ lbs. In applying the formula ‘ A ’ I found that *in every case* the result was an error *in excess,* the actual amount of error increasing more or less proportionately as the size of the fish measured also increased, thus proving that, as the *percentage* of error was fairly constant, the fault lay in the formula.

I thereupon adopted the same formula but with the following alteration, *i.e.,* that the length was taken from the mouth (closed) to the *fork* of the tail.

I will call this amended formula ‘ B.’

I then applied formula ‘ B’ to the same forty fish, but found that although this was considerably more accurate than ‘ A’ the general tendency of the error was still *in excess,* there being only four cases where the error was a ‘ minus ’ one, and of these cases the amount of error in three was negligible.

I therefore again modified the formula by substituting ‘ ¼ length ’ instead of ‘⅓ length ’, this final formula which I will call ‘ C,’ reading as follows:—

$$\frac{(L + \frac{1}{4}L) \times (G)_2}{1000} = W$$

where G is greatest girth and L is the length from the closed mouth to *fork* of tail.

On applying formula ‘ C ’ to the same forty fish again the results were even better than I had hoped.

Out of the forty fish measured in 31 cases ‘C’ was more accurate than ‘ B ’, whilst in only 3 cases did ‘A’ give a more correct result than ‘ C ’.

In only three cases did ‘ C ’ show an error in excess of one pound, (but under 2 lbs.), and these three fish were all abnormal.

In two cases the girth measurements were abnormally large in proportion to the length, and the errors shewn by ‘ A ’ for both these fish exceeded 4 lbs., whilst ‘ B ’ also showed an excess error of more than 2½ lbs. in both instances.

In the third fish the girth was abnormally small, and in this case ‘ A ’ was the most correct formula of the three.

The errors under ‘ C ’ were more or less evenly divided under + and — heads, but the general tendency (excluding the three abnormal fish) was to very slightly *under*-estimate.

The summarised statement below gives the *net* results of the experiments with the three different formulae, and also the *average* errors both including and excluding the three abnormal fish referred to above.

All the fish which were measured were caught in Lake Fife, and it is possible that these fish are of a ‘stockier’ build than those taken from running water. It would be interesting if other anglers would apply this formula to river fish and state the results. At any rate I feel certain that, so far as Lake Mahseer are concerned, it will be hard to evolve any other formula which will give better results than ‘ C, ’ a net error of less than one pound in nearly four hundred pounds of fish weighed being an extraordinarily accurate result.

All the fish were weighed on a fixed spring balance which has been carefully checked with standard weights and found absolutely correct.

SUMMARY OF TESTS.

Number of fish weighed.	Actual aggregate weight of fish in pounds.
40	393.00

NET ERRORS OF FORMULAE IN POUNDS.

‘ A ’	‘ B ’	‘ C ’
+64·64	+25·82	+ ·79

AVERAGE ERRORS OF FORMULAE IN POUNDS.

‘ A ’	‘ B ’	‘ C ’
1·61	·69	·30

Average Errors of Formulae in Pounds
(when excluding the three abnormal fish referred to above).

'A'	'B'	'C'
1·49	·59	·29

$$\text{Formula 'A'} \;—\; \frac{(L + \tfrac{1}{3}L) \;+ (G)^2}{1000} = W$$ Where L = extreme length from mouth to tail.

$$\text{Formula 'B'} \; \frac{(L + \tfrac{1}{3}L) + (G)^2}{1000} = W$$ Where L = length from mouth to *fork* of tail.

$$\text{Formula 'C'} \; \frac{L + \tfrac{1}{4} L + (G)^2}{1000} = W$$ Where L = length from mouth to *fork* of tail.

W. B. TREVENEN,
Major.

C.W.I., Poona, *February* 1925.

No. XX.—THE CEYLON RACES OF *TERIAS BLANDA*, Bdv., AND *SARI*, Horsf.

In 1881 Moore in his "Lepidoptera of Ceylon" described and figured under the name of *Terias rotundalis* what he supposed to be the two sexes of a single species, but which we now know belong to different species, *blanda* and *sari*, each represented in Ceylon by a distinct race; and as the same name cannot be borne by two species or races in the same genus, the question arises which is to have it. In all matters of naming we museum "naturalists", a maligned but harmless and even necessary crowd, grope our difficult way by means of the rules and decisions laid down by the International Commission on Zoological Nomenclature, helped out, as are all laws, by common usage. In this particular case there seems to be no definite decision that applies, but in practice it has been thought to be in accordance with the general "law of priority" that the sex whose description comes first in the text usually the ♂, should retain the name, and that what follows about the ♀ (or of course the ♂ if that comes last) should be treated as a mistaken addition and disregarded.

In cases however where the first-mentioned is already provided with a valid name, then to prevent the new name being wasted, the second partner in the ill-assorted union has been allowed in usage to retain it, and this seems on the whole a sensible plan. But in the case of *rotundalis* this concession does not apply. There was no valid prior name, for the name *citrina* introduced by Moore on the preceding page had been already used in the genus *Terias* and so was "stillborn".

Consequently, it seems to me that the first-mentioned, the ♂ needs the name and must have it, and no subsequent names (*uniformis, templetonii*) applied to the subspecies of *blanda* which the ♂ represents can alter this fact, or permit the transfer of the name *rotundalis* to the ♀ which represents the *sari* sub-species. Hence Bingham in 1907, keeps the name *rotundalis* under *silhetana* (=*blanda*) and when we find Ormiston (Spolia Zeylanica xi,p. 135-p. 158, Oct. 1919) describing and figuring the ♀ together with its proper ♂ as *rotundalis*, for the reasons given above I hold his action invalid, and propose to rename the Ceylon race of *sari* as *ormistoni*, nom. nov. and to restrict the name *rotundalis* to the race of *blanda*.

Type, Moore's original ♀ specimen, now in B. M. Description figures ♂ ♀, as above.

British Museum (Natural History),
S. Kensington.

H. T. G. WATKINS.

PROCEEDINGS.

Proceedings of the Annual General Meeting held on the 4th February 1925.

The annual general meeting of the members of the Bombay Natural History Society was held in the Board Room of the Prince of Wales' Museum on February 4 at 6 p.m. The Hon. Sir Norman Macleod presiding.

The following 21 new members were elected since the last meeting:—Mrs. J. R. Hood (England), Mr. F. X. Miranda (Savantwadi), Captain S. L. Bhatia (Bombay), Dr. R. Wittwer (Bombay), Major J. D. Scale (Assam), Mr. R. C. Richardson (Khandwa, C. P.), Mr. E. S. Lewis (Delhi), The Principal (ex-officio), of the Royal Institute of Science, Bombay; Mr. E. Sheehy (Bombay), Mr. V. S. Kupuswamy (Bellary), Dr. J. N. Leith (Lumbding, Assam), Mr. T. K. Mirchandani (Dharwar), Mrs. O. A. Geoghegan (Dera Ismail Khan), Mr. B. H. Osmaston, (Haldwani, U. P.), Mr. J. I. Miller (Calcutta), Mr. J. E. Duncan, (Mandalay), Mr. Wm. T. Tallent-Bateman (Bombay), The Mess Secretary, 5-12th F. F. Regiment, Q. V. O. Corps of Guides, Aden; Mr. E. P. Laurente (N. Shan States, Burma), Lt.-Col. F. C. Bewsher (Saraband, Palestine), Lt. L. A. G. Pinhey (Delhi).

The appointment of offices for the ensuing year was as follows:—Patron: H. R. H. the Prince of Wales, Vice-Patron—H. H. the Maharao of Cutch, President—H. E. the Rt. Hon. Lt.-Col. Sir Leslie Wilson; Vice-Presidents—The Hon. Sir Norman Macleod, H. H. the Maharao of Cutch, Rev. E. Blatter, S.J.; Managing Committee—Mr. T. Bainbridge Fletcher, Pusa; Mr. T. R. Bell, Karwar; Mr. R. D. Bell, Bombay; Mr. J. P. Bradshaw, Bombay; Mr. H. A. W. Brent, Bombay; Lt.-Col. W. H. Evans, Simla; Major F. C. Fraser, Mercara; Dr. F. H. Gravely, Madras; Prof. V. N. Hate, Bombay; Mr. J. E. B. Hotson, Bombay; Mr. C. M. Inglis, Darjeeling; Mr. F. Ludlow, Tibet; Sir Henry Macnaghten, Bombay; Mr. J. G. Ridland, Bombay; Mr. P. M. D. Sanderson, Calcutta; Major C. H. Stockley, Kohat, N. W. F. P.; Dr. D. A. Turkhud, Madras; Col. F. Wall, Maymyo; Mr. H. Whistler, Punjab; Ex-officio Members—Mr. R. A. Spence, Honorary Secretary; Mr. G. F. J. Cumberlege, Honorary Treasurer.

The Honorary Treasurer Mr. G. F. J. Cumberlege placed before the meeting the audited statement of accounts, which, together with the Treasurer's report, will be published in full in the Journal.

Continuous progress has been made in the Natural History Section of the Prince of Wales' Museum.

Members were able to inspect the new fully mounted Gaur or Indian Bison presented to the Society by the Forest Department. The animal, which is a splendid bull gaur, stands nearly 6 feet at the shoulder and carries a grand pair of horns. It was mounted in the Society's Laboratories, under the Curator's supervision, by Mr. C. McCann, the Society's Assistant Curator, and does great credit to the high standard of work achieved by the Preparation Department. The animal gives a graphic impression of the massive proportions of the Indian Gaur, the largest of existing bovines, and makes a splendid acquisition to the Mammal Gallery.

Mr. S. H. Prater, the Curator, delivered an interesting lecture on Indian Reptiles. The lecturer carried his audience back to the remote past, millions of years before man's appearance, when reptiles held dominance over the earth. He showed how reptiles were at that time adapted to every mode of existence.

At the present day reptiles no longer possessed the mastery of the earth, the sky or the sea. No reptiles possessed the power of true flight—and if we excluded the sea snakes which were comparatively small in size—no reptiles were truly marine, even the sea turtles had to come ashore to deposit their eggs. On land the reptiles no longer compared in size to their gigantic ancestors—some of them found refuge as burrowers in the earth or by hiding on its surface, others found food and shelter on trees while a number led a semi-aquatic existence on marshes, lakes and rivers.

After defining exactly what was meant by the term reptiles, the lecturer proceeded to deal with four main classes of reptiles, the crocodiles, tortoises, lizards and snakes.

Coming finally to the treatment of snake bite the lecturer explained that the trying of a ligature, incision of the wound or even amputation of the limb though recommended as being useful in reducing the amount of venom taken up in the system were of little value if a lethal dose had already been absorbed.

Science had provided an efficient remedy against the bite of the Cobra and the Russel's Viper in the anti-serum now manufactured at Kassauli and available at the Parel Laboratory. No serum was available against the bite of the Krait ; the Phoorsa and other poisonous snakes because a sufficient quantity of the venoms of these snakes was not available for the manufacture of anti-serums on a commercial basis but for this we would have a remedy against the poison of any snake. The lecture was illustrated with a fine series of lantern slides reproduced from photographs by the Assistant Curator, Mr. C. McCann.

ACCOUNTS FOR 1924.

The Honorary Treasurer Mr. G. F. J. Cumberlege placed the audited statement of accounts before the meeting. He said—"The first thing that will probably strike you is the closing accounts of Rs. 6,564-0-7 which is about Rs. 29,000 less than we opened with two years ago. The Journal Account and the Game Bird Books are the heaviest drain on our funds and it is interesting to note that about Rs. 30,000 are locked up in stock of Journals and Rs. 25,000 in Game Books—a total of Rs. 55,000. It is estimated that the other books and charts published by the Society have a value of Rs 6,000, so that in all Rs. 60,000 is locked up in stock and over Rs. 20,000 is still due to the publishers and binders for Game books not included in the above estimate. It is not very gratifying to learn that only 18 copies of each volume were sold last year. Enquiries are being received for the next volume of the Game book, but there can be no talk of further publishing activities till funds are forthcoming, and the only way we can raise funds is by members doing all they can to rope in new members and to make them buy the Society's publications. Last year the Honorary Treasurer said he hoped the Publishers of the Journal would reduce their charges, but you will see that this item has, in fact, increased, by about Rs. 1,300. No doubt the Honorary Secretary will tell us of his unsuccessful efforts to get the better of the publisher.

At the close of 1923 the number of members on the books were:—Life members 155 and ordinary members 1,131. At the close of 1924 the Life members number 161 and ordinary members 1,122, showing an increase of 6 Life members and a decrease of 9 ordinary members, 81 members joined during the year and deaths and resignations amount to 93. In terms of cash it means that our subscriptions have dropped by Rs. 3,828-7-3.

Salaries show a saving of Rs. 3,049-11-8, the increase of Rs 3,200-0-0 last year being due to Mr. Ellison's gratuity. Excluding this item, salaries have increased by Rs. 151. The Prince of Wales Museum still contributes half the salary of certain of the Society's employees.

With the exception of rent practically every other item of expenditure has been reduced, thanks to the energy of the Hon. Secretary.

The Mammal Fund. This shows a further drop, the closing balance being Rs. 4,298-2-9 against an opening balance of Rs. 10,153-5-7. Colonel Meinetzhagen is however kindly paying Mr. La Personne's salary for the next eighteen months under an arrangement which is very satisfactory to the Society. Mr. La-Personne's salary is by far the heaviest item of expenditure in the Mammal Fund.

It is proposed shortly to close the Mammal Fund and merge it into the common account. There seems no point in running two accounts and, in fact, by doing so we lose interest on our funds."

BOMBAY NATURAL HISTORY SOCIETY.

STATEMENT OF ACCOUNTS from 1st January to 31st December 1924.

Dr.

RECEIPTS.	Rs.	a.	p.	Rs.	a.	p.
OPENING BALANCE ON 1ST JANUARY 1924.						
Fixed Deposit with the Netherland Trading Society	6,000	0	0			
Balance on Current Account with National Bank of India, Ld., Bombay	4,560	10	9			
Cash on hand	250	0	0			
Balance on Current Account with National Bank of India, Ltd, London, £171-7-3 @ ¼.	2,570	7	0	13,381	1	9
Collection of Subscription in arrears	529	8	0			
,, ,, for current year ..	23,326	6	0			
,, ,, in advance ..	1,036	0	0			
	24,891	14	0			
Less—Refund of Subscription	287	9	0	24,604	5	0
Life Membership Subscription	1,574	8	0			
Entrance fees	1,800	0	0	3,374	8	0
Registration fees	335	0	0			
Sales of Journals	2,647	9	4			
,, Snake Charts	882	15	7			
,, Game Books	1,594	6	0			
,, Snake Books	79	2	0			
,, Pigeon Books	56	0	0			
,, Other printed matters	24	0	0			
,, Hand List of Birds	79	8	0			
,, Iraq Fauna	64	6	0			
,, Plates	96	0	0			
Taxidermy Charges	420	8	0			
Charges recovered	123	6	8			
Sundries	353	3	10			
Interest on Investments, etc.	3,667	10	3			
Receipts from Advt. in the Journals ..	283	12	0	10,707	7	8
Advance to Staff recovered 1923	140	0	0			
,, ,, ,, 1924	320	0	0	460	0	0
				Rs. 52,527	6	5

Cr.

PAYMENTS.	Rs.	a.	p.	Rs.	a.	p.
Journal Account	22,387	12	4			
Salaries	14,564	13	4			
General Charges, Petty Cash, etc.	1,300	14	6			
Rent	4,554	4	0			
Printing and Stationery	440	5	0			
Postage	1,293	8	0			
Library Account	232	12	8			
Furniture	112	8	0			
Audit Fee	250	0	0			
Fire Insurance Premium	187	8	0			
Profit on Snake Books paid to Col. Wall ..	62	0	0	45,386	5	10
Amount advanced to Staff during 1924 ..	....			577	0	0
Amount transferred in Mammal Fund ..	1,000	0	0			
Balance on Current Account with National Bank of India, Ltd., Bombay	2,735	5	7			
Cash on hand	150	0	0			
Balance on current account with the Nat. Bank of India, Ltd., London, £178-11-7 @¼	2,678	11	0	6,564	0	7
				52,527	6	5

Securities with the National Bank o India, Limited, Bombay.

	Rs.	a.	p.
3½% Govt. of India Pro-Notes	8,800	0	0
4 % Govt. of India Conversion Loan ..	10,000	0	0
4 % Bombay Port Trust Ungd. Bonds ..	14,000	0	0
4 % City of Bombay Imp. Trust Bonds ..	15,000	0	0
6½% Bombay Development Loan	8,000	0	0
6 % Bonds 1926 Pro-Notes	10,000	0	0
	Rs. 65,800	0	0

We have seen a letter from the National Bank of India, Ltd., Bombay, to the effect that the above Securities were held on the Society's behalf on 31st December 1924, also a certificate from the National Bank of India, Ltd., London, for the balance with them.

BOMBAY, *30th January* 1925.

Examined and found correct.
(Sd.) A. F. FERGUSON & Co.,
Chartered Accountants, Auditors.

(Sd.) G. F. J. CUMBERLEGE,
Honorary Treasurer,
Bombay Natural History Society.

(Sd.) A. F. FERGUSON & Co.,
Chartered Accountants, Auditors.

MAMMAL FUND ACCOUNT.

BOMBAY NATURAL HISTORY SOCIETY.

Dr. *STATEMENT OF ACCOUNTS from 1st January to 31st December* 1924. Cr.

Dr.	Rs. a. p.	Rs. a. p.
OPENING BALANCE ON 1ST JANUARY 1924.		
Fixed Deposit with Netherlands Trading Society at 3½ per cent.	9,000 0 0	
On Current Account with the National Bank of India, Ld., Bombay	1,153 5 7	10,153 5 7
Interest on Current Account	29 13 0	
„ Fixed Deposit	341 9 7	
Sale proceeds of gun	111 0 0	482 6 7
Loan from Society's account		1,000 0 0
		11,635 12 2

Cr.	Rs. a. p.	Rs. a. p.
Salary of Mr. V. S. LaPersonne	3,622 10 0	
„ Mr. C. McCann	1,400 0 0	5,022 10 0
Cost of Cartridges	202 10 0	
Audit fee	30 0 0	
Freight on Specimen boxes, &c	212 6 6	
Travelling expenses to Collector	259 8 0	
General charges and Sundries	179 4 9	
Postage and Telegrams	56 5 0	
Collecting expenses	1,374 13 2	2,314 15 5
Fixed Deposit with Netherlands Trading Society at 4½ per cent	3,500 0 0	
On Current Account with National Bank of India, Ld., Bombay	798 2 9	4,298 2 9
		11,635 12 2

BOMBAY, 30*th January* 1925.

Examined and found correct.

(Sd.) A. F. FERGUSON & Co.,

Chartered Accountants, Auditors.

(Sd.) G. F. J. CUMBERLEGE,

Honorary Treasurer,

Bombay Natural History Society.

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S. H. PRATER, C.M.Z.S.

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CONTENTS OF Vol. XXX, No. 4.

PAGE

THE MAMMALS AND BIRDS OF KASHMIR AND THE ADJACENT HILL PROVINCES. Part V. By Col. A. E. Ward. (*With a plate and text-figures.*) 719

BIRDS OF THE PERSIAN GULF ISLANDS. By C. B. Ticehurst, M.A., M.R.C.S., M.B.O.U. (*With 4 plates and a map.*) 725

A NEW SNAKE FROM BURMA. By Col. F. Wall, C.M.G., K.H.S. 734

AN ORIENTAL HUNTING WASP (*Sphex lobatus*). By Major R. W. G. Hingston, I.M.S. 735

AN ACCOUNT OF SOME FRESH WATER CILIATES FROM LAHORE. By Amir Nath Gulati, M.S.C. (*With two plates*). 744

THE IDENTIFICATION OF INDIAN BUTTERFLIES. Part VIII. (*With a plate.*) By Col. W. H. Evans, D.S.O., F.Z.S., F.E.S. 756

ON THE ANTIQUITY AND THE THERAPEUTIC USES OF THE INDIAN SPIKENARD. By S. C. Sinha, M.A. (*With a plate.*) 777

TWO NEW THYSANOPTERA FROM SOUTH INDIA. By T. V. Ramakrishna Iyer. (*With a plate and a text-figure.*) 788

BIRDS NESTING WITH A CAMERA IN INDIA. Part V. (*With 5 plates.*) By Capt. R. S. P. Bates 793

NOTES ON SNAKES COLLECTED IN BURMA IN 1924. By Col. F. Wall, C.M.G., K.H.S. 805

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA. Part XXXV. By T. R. Bell, C.I.E., I.F.S. (Retd.) 822

A FEW DAYS AFTER URIAL OF THE PUNJAB. By Lt.-Col. R. W. Burton, I.A. (Retd.) 838

INDIAN DRAGONFLIES. Part XXII. (*With a plate and text-figures.*) By Major F. C. Fraser, I.M.S., F.E.S. 846

NOTE ON A NEST OF THE COMMON INDIAN HORNET. (*With a plate.*) By B. Chopra, D.SC. 858

AN ANNOTATED LIST OF THE THYSANOPTERA KNOWN FROM INDIA AND CEYLON. By T. V. Ramakrishna Iyer. 861

NOTES ON THE BIRDS OF SIKKIM HIMALAYAS. PART VII. (*Conclusion.*) By Herbert Stevens, M.B.O.U. 872

REVIEWS :—THE PROTECTION OF BIRDS. By Lewis R. W. Loyd........ 894
A MONOGRAPH OF THE BIRDS OF PREY. Part I. By H. Kirke Swann, F.Z.S., M.B.O.U. 894
NATURE AT THE DESERT'S EDGE. By R. W. G. Hingston, M.C., M.B., I.M.S. 896
FAMILIAR FLOWERING TREES IN INDIA. By Ida Colthurst. 898

OBITUARIES :—Prof. H. Maxwell Lefroy ; Prof. F. Hallberg ; Mr. L. J. Sedgwick, I.C.S. 899

EDITORIAL. 902

PAGE

MISCELLANEOUS NOTES :—

I.—The Slow Loris. By Major J. D. Scale 904

II.—The Occurrence of Hodgson's Bat. By E. A. D'Abreau, F.Z.S. 905

III.—The 'Sambhar Call' of the Tiger. By A. A. Dunbar Brander 905

IV.—Tiger Netting in Assam. By L. J. Delanougerede, D.F.O. ... 907

V.—Panther with abnormal feet. By Maharaj Kumar Shree Vijayarajji. 909

VI.—Abnormal clavicle bones of a Tiger. By Lt.-Col. W. G. Hutchinson. 910

VII.—Panther and Wild Dogs. By Lt.-Col. R. W. Burton. 910

VIII.—A Hybrid Black Buck and Chinkara. (*With a photo.*) By Maharaj Kumar Sri Sadul Singhji Bahadur. 911

IX.—Duel between two Bull Elephants. By H. F. Mooney, I.F.S.. 912

X.—An Elephant Trap. By C. G. Selignman. 912

XI.—Crows' Nests and Electric Cables. By S. H. Prater, C.M.Z.S.. 913

XII.—Predatory Habits of the Magpie. By Lt.-Col. F. M. Bailey... 914

XIII.—Fresh Light on the Identity of the 'Devil Bird.' By Editors. 914

XIV.—Hawks and Swallows. By Major J. D. Scales, D.S.O., O.B.E. 915

XV.—An Albino Hoopoe. (*With a photo.*) By Mrs. H. K. Rudkin. 916

XVI.—Occurrence of the Nepal Kalij Pheasant at Mussoorie. By F. Field. 917

XVII.—Breeding of the Painted Sand-Grouse in the Punjab Salt Range. By H. W. Waite, F.Z.S., M.B.O.U. 917

XVIII.—The Nesting of the Little Green Heron in the District of 24-Pergannas. (*With a photograph*) By Satya Churn Law. 918

XIX.—Weights of Woodcock in Shillong. By Lt.-Col. G. R. Row, I.A. (Retd.) 919

XX.—Records with Snipe. By Udaji Rao Puar. 920

XXI.—The Snake *Natrix venningi*. (Venning's Keelback). By Col. F. Wall. 921

XXII.—Two Common 'Fire Fishes' of Madras. By S. T. Moses 921

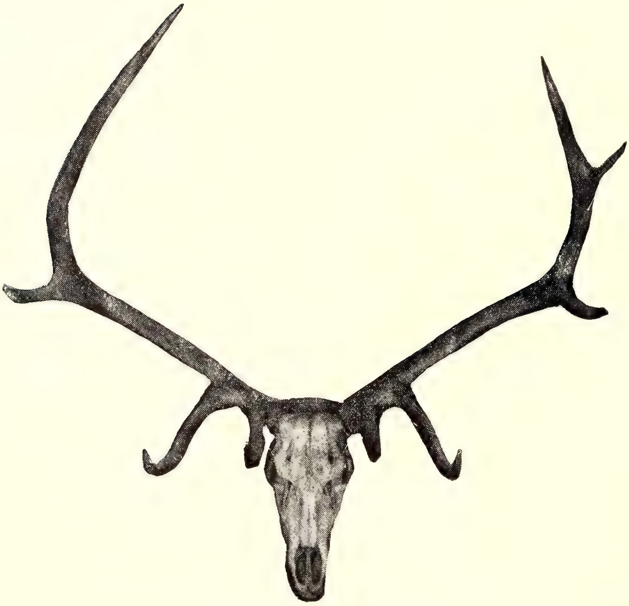
XXIII.—A Run of Fish on the Streams falling into the Yamdrok Tso. By Lt.-Col. F. M. Bailey. 922

XXIV.—Extraordinary Display of '*Leucodice Soracte*' of the Genus 'Aporia.' (*With a plate*). By R. Y. A. Morshead. 923

XXV.—*Coptosoma ostensum*, Dist. and its enemy *Synia melanaria*, Muls. By T. V. Subramanyam, B.A. 924

Proceedings. 926

SHOU (*Cervus wallichi*)
Shot by Major A. de C. Rennick



SHOU (*Cervus wallichi*)
Bombay Nat. Hist. Society's Collection

JOURNAL

OF THE

Bombay Natural History Society

Dec., 1925 Vol. XXX No. 4

THE MAMMALS AND BIRDS OF KASHMIR AND THE ADJACENT HILL PROVINCES

Being Natural History Notes

BY

Col. A. E. Ward

Part V

(*Continued from page* 524 *of this volume.*)

(*With one plate and three text figures.*)

[1] *CERVIDAE :* The Deer (*contd.*)

The Shou.—*Cervus wallichi.*

There seems to be little doubt as to the habitat of this fine deer, which may be briefly stated as Northern Bhutan and the Tangpo and Brahmaputra Valleys and Southern Tibet.

Not many Shou have been shot by Europeans, but several pairs of horns have been purchased or given to travellers.

The head figured on the plate is in the Bombay Natural History Society's collection. Plate 1 also shows a Stag shot by Major A. de C. Rennick, who kindly sent me the photograph. Rowland Ward gives the measurements:—

Outside curve	Girth	Tip to tip	Points
46″	5 and $\frac{7}{8}$	25″	5 + 5

Colonel F. M. Bailey, to whom I am much indebted, shot a Shou on September 12, 1913; the description was published in *The Field*, October 3, 1914. Reference can only be made to Bombay Natural History Society's Journal, XXIV, No. 1, where Bailey's interesting notes from Southern Tibet are published.

Hodgson, many years ago, presented a head ($55\frac{3}{4}''$ × $6\frac{1}{2}''$) of ten points to the British Museum. Major Rennick also gave his specimen and Mr. A. O. Hume had two or three pairs of horns and these he bequeathed to the same Museum. Colonel Bailey also found horns of 54″ and Colonel Tanner brought down from Northern Bhutan a beautiful head, of the same length. This was in Simla for some years and was greatly admired. I do not know from where Lydekker copied the Shou's head he shows as a typical specimen, but it is very like Tanner's. The brow antler appears to be short, as is the case generally with the Hangul or Kashmir Stag, but exceptions are found to occur in both species—the third tine is shorter than the second in most antlers. On Major Rennick's specimen the brow antler is well developed.

---

[1] The previous article on the *Cervidae* of Kashmir appeared on pages 253 *et seq.* of this volume.—Eds.

Compared with the Kashmir Hangul the skull of the Shou is very much larger : the Hangul's skull is in extreme length from 15½″ to 16″ whilst the skull of a Shou is 17½″ and Blanford gives a measurement of 18¼″.

Judging from the comparatively few antlers about whose identity there is no doubt, the number of points are, like the Kashmir Stag, normally 5 + 5 in number ; but one of Mr. Hume's specimens was 7 + 6, and Rowland Ward gives two others as 8 + 6 and 6 + 5. Again, Lydekker mentions a head with 13 points from a valley not far from Lhassa.

The Shou is amongst the largest of the Red deer, the antlers are not unlike those of the Hangul, the beam bends forward from the trez tine and the shape of the beam is not unlike that of the Spotted deer.

The subdivision of the Shou deer into two races appears to be unjustifiable, and the report of its existence near the sacred lakes of Mansarowar appears to be untrue, anyone who has gone up the Sutlej to its source must know that there is no grazing or browsing to be had. Not very far to the southward is the Tarai where there are no Shou, and the Tarai is the only forest in which this huge deer could exist.

Thorold's Deer.—*Cervus albirostris.*

Thorold's Deer is of medium size ; it is brown in colour with the inner portion of the ears white ; so also is the muzzle. The yellow on the buttocks is very plainly to be seen. There is no trez tine.

It is believed that Przewalski first obtained this deer, and Dr. Thorold undoubtedly obtained two specimens north of Lhassa ; in consequence arose the name of 'Thorold's' deer or '*Cervus thoroldi*.' The habitat is northwards and north-eastward of Lhassa.

The largest horn is mentioned on page 31 of Rowland Ward's *Records of Big Game* (eighth edition of 1922).

Length of horn on outside curve	Tip to tip	Widest inside	Points
47″	34¼″	36½″	5 + 5

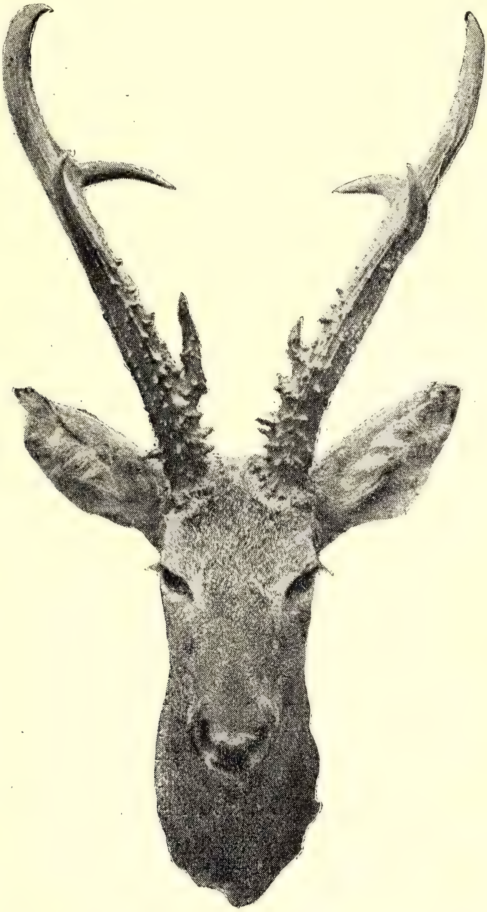
The locality is Central Tibet : what is exactly meant by Central Tibet it is difficult to determine, but probably the habitat given above is more appropriate.

The only photograph I have is not my property nor do I know where the horn was found.

Knowing so little about the deer I propose to conclude this portion of the article with the remark that Thorold's deer is a distinct species.

Having now dealt with the Elaphine group of deer let us take up the beautiful Roe that is called the Siberian Roe deer or the Asiatic Roebuck.

Genus *CAPREOLUS :* ROE DEER.



The Siberian Roe.—*Capreolus pygargus.*

THE SIBERIAN ROE.—*Capreolus pygargus.*

The common native name is *Illik*. The late Mr. Church writes on the subject of this animal, giving details of its pursuit. The distribution is the Altai, parts of the Caucasus, Turkestan, etc.[1]

---

[1] The typical race is from the Semiretshinsk Altai,

The Thian Shan race is called '*tianschanicus*'. Some of the finest heads are from the Thian Shan, notably one shot by Col. C. B. Wood, who very kindly contributed the beautiful photograph.

Length on outside curve	Circumference	Tip to tip
17″	$4\frac{3}{8}$	$12\frac{3}{4}$″

These are Rowland Ward's measurements. One longer is mentioned on page 85 of his records. Numbers of this animal have been shot.

Years ago I arranged with the late Rajah Sir Amar Singh to endeavour to import and acclimatize the Siberian, or as it is generally called, the Manchurian Roe in the State Game Reserves belonging to His Highness the Maharajah. The plan fell through when I left Kashmir in 1908; since then, the importation of this Roe has been talked about. Roe deer are difficult to deal with in captivity, but if they could be brought down safely they ought to do well, provided the leopards and Indian martens could be kept down. The climate of Kashmir would be quite suitable.

Genus *Muntiacus:* Barking Deer.

The Barking Deer.—*Muntiacus vaginalis.*

The Barking deer is widely known in India and in the Himalayas as the *Khakur.* I have never heard the name *Jungly Bakri* except in parts of the Central Provinces.

The range includes India, Burma, the Malay Peninsula, Siam, Java, Sumatra, Borneo, etc. The several races that are distributed over this wide area need not be dwelt upon in the present paper. A short—horned species known as *Muntiacus crinifrons* occurs in Eastern China.

Distribution. Throughout most parts of India, in Burmah, Ceylon, etc.—in most of the hilly tracts.

Most sportsmen have shot the Barking deer, coming on the nimble little animal suddenly in the more open forest, or hearing its peculiar startled call in the dense ringal clumps or amongst bush jungle—the startled call is distinctly a bark of fright.

Personally, I have always had a dislike to shooting this delightful deer owing, as I do to it, success in getting a tiger, that was the terror of the lower Siwalik Hills, and in ridding the vicinity of hill stations of dog-eating leopards.

The Barking deer has long upper teeth or tusks protruding from the gums. With these tusks the animal can cause gashes. Gunga, a grand companion who followed me for years, was once badly cut in the fleshy part of the thumb, by the tusks of a Muntjac; the wound took weeks to heal.

If the Barking deer can be got to feed and are allowed to be loose they thrive well. Being inordinately fond of grain, they must be carefully guarded on the march. A tame barking deer used to jump up into a Bunniah's cart; finally it succumbed to eating too much grain.

Dunbar Brander puts the weight of a good buck at 48 lb., height at shoulder 24 inches. A female weighed close on 38 lb., that is an abnormal weight. The average of five very large bucks was—height, 26″; weight 46 lb. A really good horn is given on page 217 in Mr. Dunbar Brander's delightful work, *Wild Animals in Central India.*

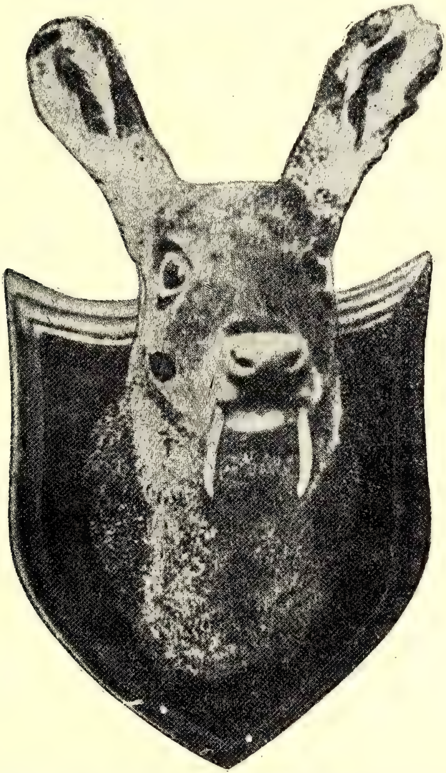
Horn outside curve	Girth	Tip to tip
7″	3¾″	3⅛″

The hairy pedicle which carries the horn measures about 4″. Barking deer cast their horns annually. I see no reason to doubt this fact, undoubtedly the horns are shed in the summer months when few sportsmen care to tramp about amongst the hills, and as the horns are generally hard by October the idea has been formed that this deer does not shed its horns year by year. Living as I have done in the jungles throughout the year I have always seen hornless muntjac in July and August and have frequently picked up fallen horns.

The colouring varies from dark to fairly light red; the stomach, under the jaw and part of the throat are white as a rule.

Females are said to be of a lighter red, but this is not very marked.

Genus *Moschus*: MUSK DEER.



The Musk Deer.—*Moschus moschiferus moschiferus.*

THE MUSK DEER.—*Moschus moschiferus moschiferus.*

Kastura (=Musk) is the native name in most of the Himalayas—*Rebjo* in Laddak. *Rous* and *Kastura* in Kashmir.

Distribution.—The Himalayas extending from the East to Gilgit on the west. Found also in China and Siberia. The Chinese race to the westward is called *Moschus moschiferus sifanicus.*

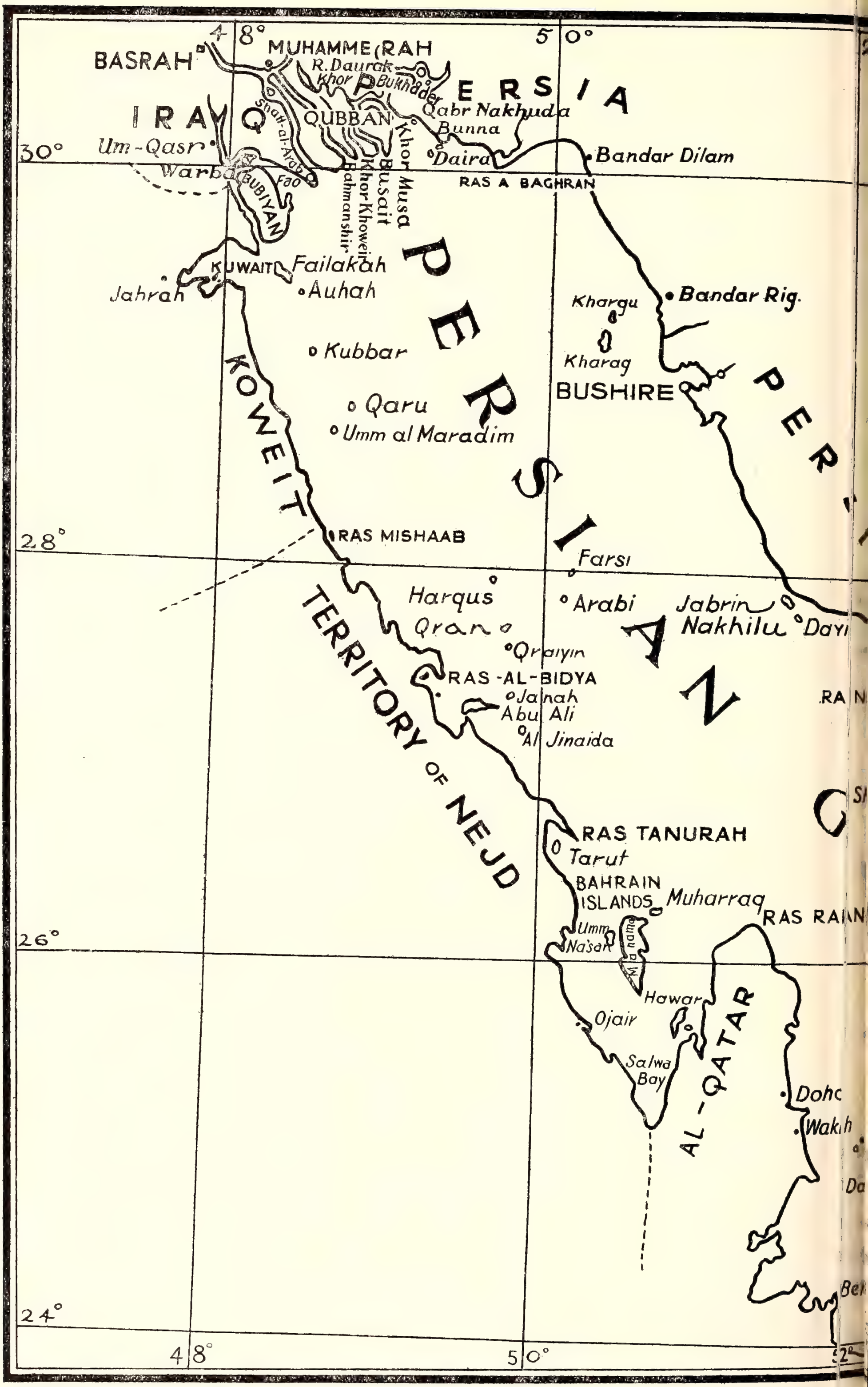
The Musk deer varies considerably in size, ranging from 22 to 30 lb. in weight with a shoulder height of about 19 inches ; the hind quarters have frequently a height of 21 to 22 inches. The fur is coarse and brittle, in fact, the body covering is more in the nature of soft spiky hair, which breaks easily. This renders the skin useless as a trophy.

This deer is hornless in both sexes. The only trophy obtainable is the pair of tusks in the upper jaw, which measure from about 2 to 3½ inches ; these tusks are imbedded in the gums. The maximum total length of the tusk is about 3½ to 4 inches. The glandular pouch which holds the musk is greatly sought after, as much as Rs. 32 being, at times, paid for what is called the musk pod. Consequently in spite of all precautions Musk deer are decreasing in numbers year by year, and, but for this deer being preserved as a ' royalty ', (i.e., belonging to the ruling chief), it would have become extinct in Kashmir.

Very little sport is to be obtained from the pursuit of the Musk Deer. After a pair of the canine tusks have been secured these small animals should be left in peace ; sufficient enemies exist, without bringing the modern small bore rifle to lessen the numbers of a forest-living animal. The nets and shot guns of poachers and leopards, wild dogs, Indian martens, foxes, etc., all prey on the Musk deer.

Years ago at Badiar in the Jinsar Forests of the United Provinces an effort was made to populate with these deer a fairly large tract of hillside. Every aid was afforded by nature and suitable food, shade, rocks and shrubs existed. At first many Musk deer tenanted the country which was preserved. One morning, whilst out after Cheer pheasants, I put up many without any beaters, a few years afterwards not a single Musk deer was to be found, they had all dispersed. This only shows how fruitless it is to try and interfere with the laws which govern wild animal life. Whether the Musk deer objected to being overcrowded, or had eaten up the selected portions of the herbage it is impossible to say—perhaps disease had occurred—it is useless to speculate. Undoubtedly it is always the case that overcrowding causes disease and at that we must leave it. But for the intervention of man, wild animals would still be plentiful, the reproduction of the jungle fauna if left alone would be balanced by nature, the numbers would possibly fluctuate as the vermin gained the ascendency ; as the game decreased the flesh-eating animals would wander off to better hunting grounds, the numbers of the animals on the devastated ground would again increase and so on *ad infinitum.*

(*To be continued*)


48°
50°
BASRAH
MUHAMMERAH
R. Daurak
Khor Bukhader
PERSIA
IRAQ
Shatt-al-Arab
QUBBAN
Khor Musa
Qabr Nakhuda
Bunna
30°
Um-Qasr
Warba
BUBIYAN
Fao
Busait
Khor Khowein
Bahmanshir
Daira
Bandar Dilam
RAS A BAGHRAN
KUWAIT
Failakah
Jahrah
Auhah
PERSIAN GULF
Khargu
Bandar Rig.
Kharag
Kubbar
BUSHIRE
PER
Qaru
Umm al Maradim
KOWEIT
28°
RAS MISHAAB
Farsi
Harqus
Arabi
Jabrin
Nakhilu
Dayi
TERRITORY OF NEJD
Qran
Qraiyin
RAS-AL-BIDYA
Janah
Abu Ali
Al Jinaida
RA
S
RAS TANURAH
Tarut
BAHRAIN ISLANDS
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Hawar
AL-QATAR
Ojair
Salwa Bay
Doha
Wakrah
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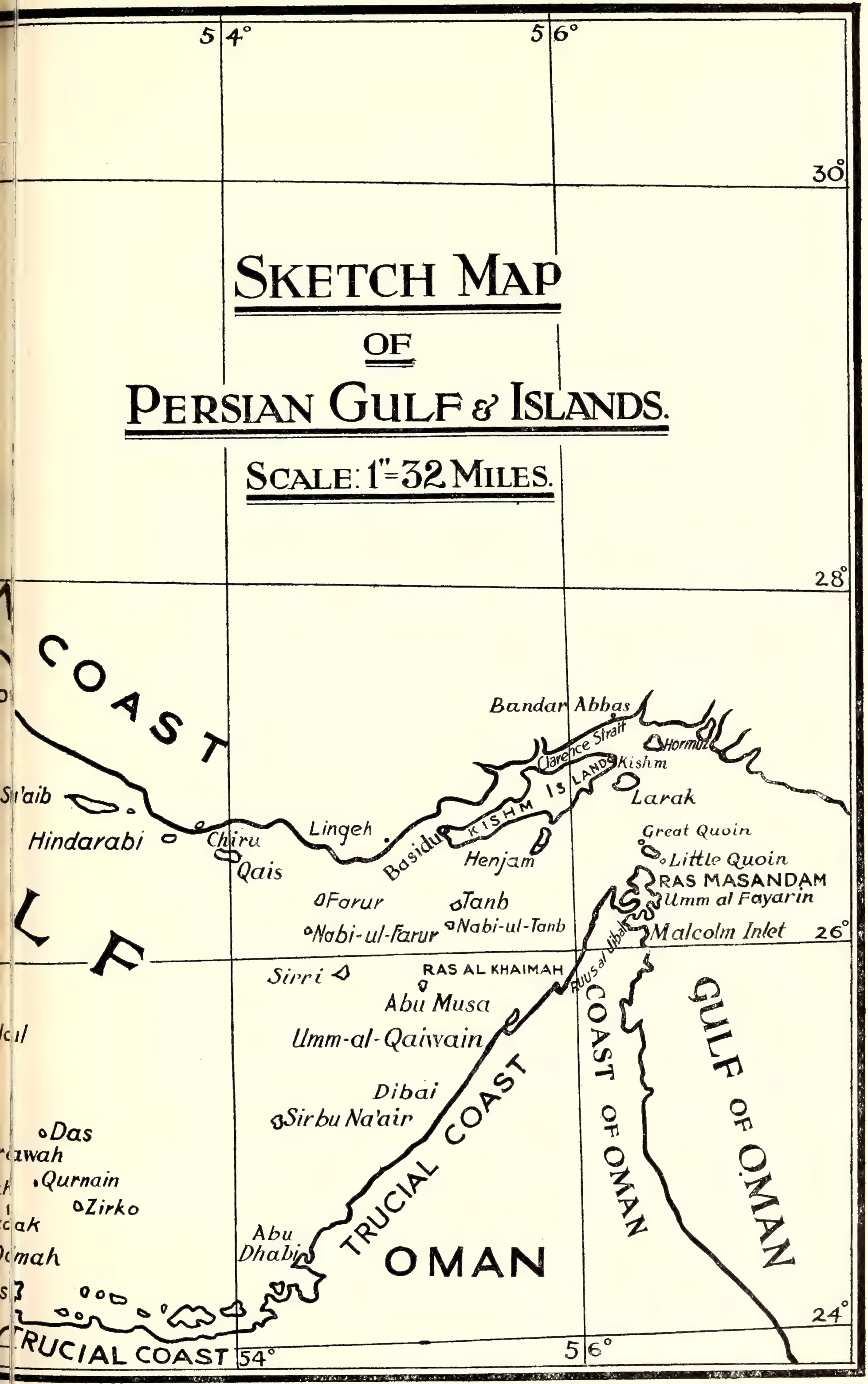
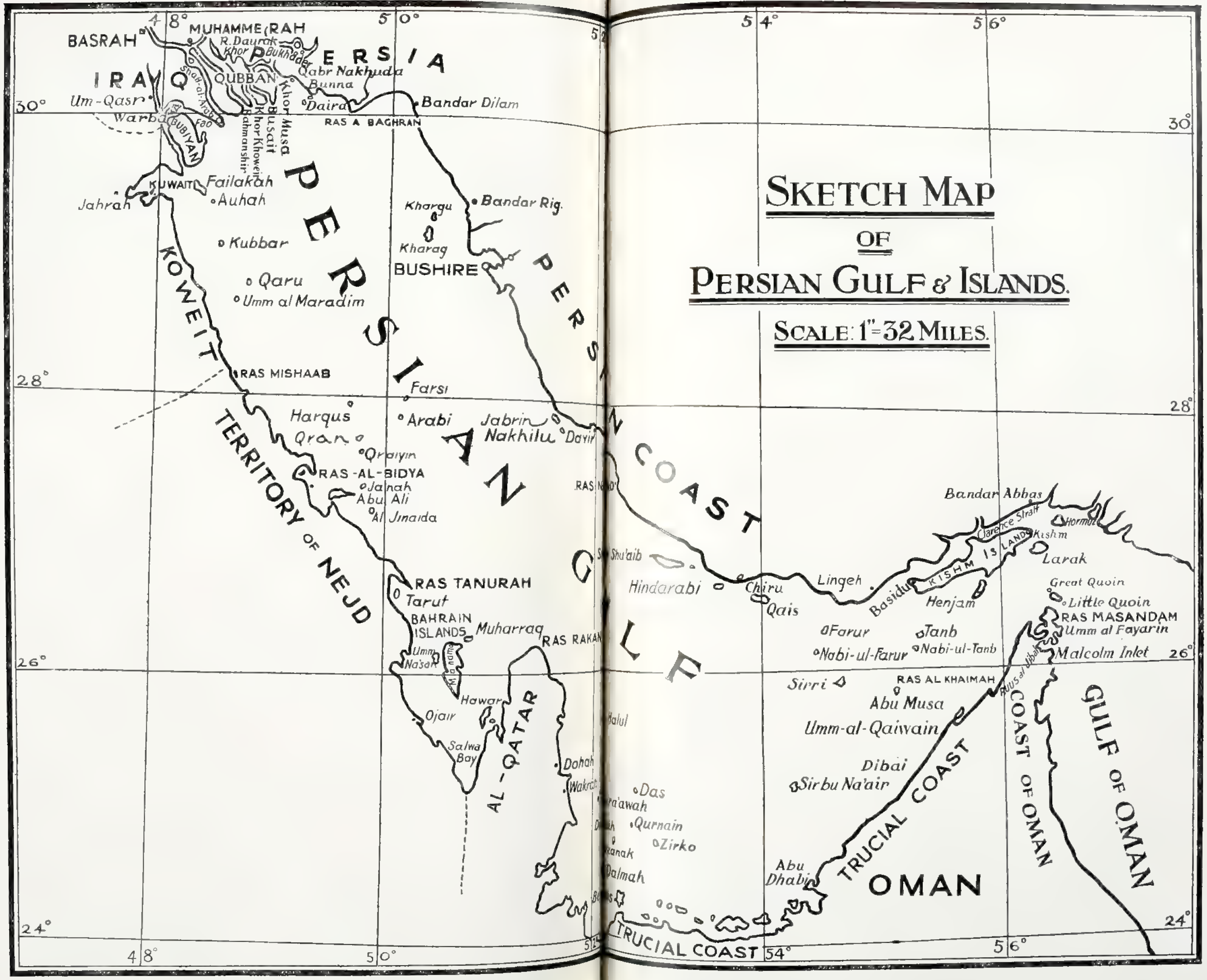


SKETCH MAP OF PERSIAN GULF & ISLANDS.

SCALE: 1" = 32 MILES.

54°
56°
30°
28°
26°
24°
COAST
L F
S'aib
Hindarabi
Chiru
Qais
Lingeh
Basidu
KISHM ISLAND
Henjam
Clarence Strait
Bandar Abbas
Hormuz
Kishm
Larak
Great Quoin
Little Quoin
RAS MASANDAM
Umm al Fayarin
Malcolm Inlet
Farur
Nabi-ul-Farur
Tanb
Nabi-ul-Tanb
Sirri
RAS AL KHAIMAH
Abu Musa
Umm-al-Qaiwain
Dibai
Sirbu Na'air
Ruus al Jibal
COAST OF OMAN
GULF OF OMAN
TRUCIAL COAST
OMAN
Abu Dhabi
Das
Qurnain
Zirko
RUCIAL COAST



SKETCH MAP OF PERSIAN GULF & ISLANDS.

SCALE: 1"=32 MILES.

48°
50°
54°
56°
30°
28°
26°
24°
BASRAH
MUHAMMERAH
R. Daurak
Khor Bukhader
PERSIA
IRAQ
QUBBAN
Shatt-al-Arab
Qabr Nakhuda
Bunna
Um-Qasr
Warba
BUBIYAN
Fao
Bahmanshir
Khor Khoweir
Busait
Khor Musa
Daira
Bandar Dilam
RAS A BAGHRAN
KUWAIT
Failakah
Auhah
Jahrah
Kubbar
Qaru
Umm al Maradim
KOWEIT
PERSIAN GULF
Khargu
Kharag
Bandar Rig
BUSHIRE
PERSIAN COAST
RAS MISHAAB
Farsi
Harqus
Arabi
Qran
Jabrin
Nakhilu
Dayir
Qraiyin
RAS-AL-BIDYA
Jainah
Abu Ali
Al Jinaida
TERRITORY OF NEJD
RAS NAND
Shu'aib
Hindarabi
Chiru
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Nabi-ul-Tanb
RAS TANURAH
Tarut
BAHRAIN ISLANDS
Muharraq
RAS RAKAN
Umm Na'san
Manama
Hawar
Ojair
Salwa Bay
AL-QATAR
Halul
Dohah
Wakrah
Sirri
RAS AL KHAIMAH
Abu Musa
Umm-al-Qaiwain
Ruus al Jibal
Dibai
Sir bu Na'air
Das
Qurnain
Zirko
Dalmah
Abu Dhabi
TRUCIAL COAST
OMAN
COAST OF OMAN
GULF OF OMAN

BIRDS OF THE PERSIAN GULF ISLANDS

BY

CLAUD B. TICEHURST, M.A., M.R.C.S., M.B.O.U.
(LATE CAPT., R.A.M.C.)

ASSISTED BY

MAJOR-GENERAL SIR PERCY Z. COX, G.C.M.G., G.C.I.E., K.C.S.I., M.B.O.U.

AND

MAJOR R. E. CHEESMAN, M.B.O.U., F.R.G.S.

(*With four plates and a map*)

During the last four or five years a considerable amount of information has been gathered together about the bird life on various islets in the Persian Gulf, with a large collection of skins and series of eggs. The skins were presented to the British Museum and the Bombay Natural History Society and the eggs to the British Museum and Mr. E. C. S. Baker. Some islands were visited by Sir Percy Cox and Capt. R. E. Cheesman personally and to others Sir Percy Cox sent his collector Mr. La Personne to investigate. I have considered it best to refer to the avifauna of each island separately as the islets visited extend from the extreme north-west to the extreme south-east of the Gulf, a matter of some 550 miles. This paper is founded therefore on notes made by the above three observers and on specimens brought home. Notes on the eggs of the Tropic Bird and Cormorant have been kindly supplied me by Mr. Stuart Baker.

Starting at the south-eastern end at the entrance to the Gulf :—

I. GREAT AND LITTLE QUOIN.

Two rocky islets, with a lighthouse, situated under Ras Masandan, the high rocky headland of Oman. Visited by Sir Percy Cox and Capt. Cheesman, September 23, 1920, who landed on Little Quoin. Several pairs of *Phaëton ætherius indicus* were flying round and in and out of crannies and probably had bred there. An Osprey and a pair of *Corvus corax ruficollis* seemed to be the only inhabitants. I may state that I have seen a clutch of three eggs of the Osprey said to have been taken on this island prior to 1914. On March 16, 1921, Swifts were seen doubtless, *Micropus murinus*, entering crevices in the cliff on the south side, the flock composed quite 200 birds but Capt. Cheesman could not be sure that they were breeding there. A few *Phaëtons* were seen near the island.

On May 6, some Persian Shearwaters were seen off the islands ; on April 9, many were seen at sea off Ras-al-Hadd, Gulf of Oman, flying south, where also thousands of Red-necked Phaleropes were observed in flocks of 10 to 20. These flocks fly in the trough of the waves and just skim the crest. They swim with ease in a rough sea and are always very wild. (R. E. C.)

II. HENJAM.

This small island, five miles long and 2½ broad, lies on the Persian side of the Straits of Ormuz under the lee of Kishim Island which itself is separated from the Persian mainland by Clarence Strait on the north. It is an important cable station of the Indo-European Telegraph Company and port of call for the B. I. Company's steamers. There is a native village with 30 houses and date groves on the western side and a larger village exists in the south.

Col. Butler was there for three days, May 17 to 20, 1877 (*S. F.*, vol. v) and Capt. Cheesman spent a few hours ashore on March 15 and 17, 1921. It is of volcanic formation with strata of shells, rocks and larva, and very little sand. At the south end there are a few bushes and about half a dozen Sidera trees (*Zizyphus* sp.) up to twenty feet high are dotted about the island. Hills rise 350 feet and are very bare. The following are recorded :—

Raven. *Corvus corax* subsp. A raven was seen on March 15 which Cheesman thought was *ruficollis*.

Crested Lark. *Galerida cristata* subsp. A few pairs are resident, noted by Cheesman and Butler. No specimens.

White-eared Bulbul. *Pycnonotus leucotis* subsp. A few pairs are resident. Cheesman saw old nests in the Sidera trees. No specimens.

Great Grey Shrike. *Lanius excubitor.* Butler records this in May as *lahtora* ; more probably it is *aucheri* and it must be resident.

Osprey. *Pandion haliaëtus.* A pair were seen on March 15 by Cheesman ; they were 'very agitated' so probably had a nest on the island.

Black Kite. *Milvus migrans.* Seen on March 15.

Egyptian vulture. *Neophron percnopterus.* Several seen on March 15. Possibly resident.

Macqueen's Bustard. *Chlamydotis undulata macqueeni.* Butler was told that a pair had been shot in the first week of April 1877 and that the female had an egg ready for extrusion.

Cormorant. *Phalacrocorax carbo* ? Cheesman saw numbers in the vicinity on March 15.

Red-wattled Lapwing. *Lobivanellus indicus aigneri.* This Lapwing was noted by Butler and must have been resident.

Kentish Plover. *Charadrius alexandrinus alexandrinus.* Noted in March and May 20, is doubtless resident.

Little Ringed Plover. *Charadrius dubius curonicus.* Obtained on March 15.

Oystercatcher. *Hæmatopus ostralegus longipes.*
Curlew. *Numenius arquata lineatus.*
Common Sandpiper. *Tringa hypoleucus.*
Noted on March 15.

Red-necked Phalerope. *Phaleropus lobatus.* Noted at sea in the vicinity in March and as late as May 17.

Reef Heron. *Demiegretta sacra asha.*
Slender-billed Gull. *Larus genei* (= gelastes).
Black-headed Gull. *Larus ridibundus.*
Noted on March 15.

Sooty Tern. *Sterna anæthetus fuligula.*
Lesser Crested Tern. *Sterna bengalensis bengalensis.*
Noted on March 15 and May 17.

Large Crested Tern. *Sterna bergii velox.*
Sandwich Tern. *Sterna s. sandwichensis.*
White-cheeked Tern. *Sterna repressa.*
Obtained on March 15 at Kishim.
Noted on May 17.

III. Tanb and Nabi-u-Tanb.

Tanb Island situated at the eastern end of the Persian Gulf in Lat. 26° 16″N. and Long. 55° 19′E. will be familiar to those who have gone from Indian ports up to Basra, as the British India Company's ships pass within a mile or so of the island. As there is a lighthouse and water on the island it was chosen by Sir Percy Cox as a suitable place to send a collector in order to see to what extent migration could be observed and what species halted there during the spring passage. After a preliminary visit by Sir Percy Cox and Capt. R. E. Cheesman and with the kind co-operation of the Director, Royal Indian Marine, the collector was sent to live on the island during the period March 13 to April 14, 1921.

The island is about eight miles in circumference and consists of a volcanic nucleus with a large accretion of coral round it. On the east side is a flat shelving silvery strand and towards the centre of the island the land rises by a series of ridges of volcanic rock to 165 feet where the lighthouse stands. The light is visible for twenty-one miles. The western side is rocky with occasional sand beaches. On the north-east the land ends in a cliff thirty to forty feet high. At the south end there is an Arab village with three wells, a clump of date palms, two banyan trees and a small amount of cultivation. Most of the island is desert, the low parts support a certain amount of *Sueda* bushes while in the valleys between the ridges there are dwarf acacias some of which attain the size of bushes fifteen feet high.

The lighthouse failed to add a single specimen ; no doubt in the clear atmosphere of the Persian Gulf night, birds are not attracted to the lantern and I found the same thing at Manora Light, Karachi.

Nabi-u-Tanb lies seven miles south-west of Tanb and is one mile long and three and a quarter miles broad with a rocky hill 116 feet high ; it is barren, uninhabited and without water.

Sixty-three species are now recorded from the two islands and in nearly every case the identifications are borne out by specimens ; only seven species are resident—Raven, Great Grey Shrike, Crested Lark, Osprey, Norfolk Plover, Kentish Plover and Reef Heron. Three are breeding visitors—Sooty Tern, White-checked Tern and Tropic Bird. The rest are passage migrants except perhaps a few Waders, Chiffchaff, Isabelline and Desert Wheatears which may be winter visitors, while the exact status of several are doubtful :—

Brown-necked Raven. *Corvus c. ruficollis.* One pair inhabits the island, breeding on the ledge of a clay cliff. On March 24 they had three young.

Grey-backed Warbler. *Aëdon g. familiaris.* One on March 24 ; a few on March 29 in scrub on the hillside.

Upcher's Warbler. *Hippolais languida.* Fairly common on April 2 when there was a small ' rush ' of Warblers which took shelter under walls and in thorn bushes in the small bushy valleys ; one secured April 3.

Eastern Orphean Warbler. *Sylvia h. crassirostris.* Noted from March 30 to April 2 during the rush.

Menetries' Warbler. *Sylvia mystacea.* Came in in numbers on April 1 and 2.

Desert Warbler. *Sylvia n. nana.* One obtained in bushes on the hill—top on April 2.

Chiffchaff. *Phylloscopus c. collybita.* A female W 58 obtained March 29 is quite indistinguishable from English specimens.

Brown Willow Warbler. *Phylloscopus c. tristis.* One obtained on March 30. Chiffchaffs were present on the island on arrival on March 13 and an influx took place on March 30. They frequented the date garden chiefly.

Great Grey Shrike. *Lanius e. aucheri* : Resident and one of the commonest birds on the island, frequenting the acacias. In about every fifth bush there were nests of varying ages. On March 19 a nest contained young already, but some were building yet and in some cases old nests appeared to be repaired. Eggs were found up to April 12 and four seemed to be the usual clutch. A larder discovered on March 21 close to a nest contained a chick of a Wader (probably Kentish Plover) and two shrike chicks belonging to some other pair. Shrikes were present on the island on September 23.

Bay-backed Shrike. *Lanius vittatus.* Two seen and one obtained March 24. Status doubtful. This is the most western record of this Indian species, of which a point from 100 miles W.N.W. of Bampur in Persian Baluchistan has hitherto been the western limit.

Masked Shrike. *Lanius nubicus.* Several noted and obtained on passage between March 24 and 28 frequenting low acacia bushes. This is an extension of this bird's range eastward ; Blanford did not meet with it in Eastern Persia.

Isabelline Shrike. *Lanius isabellinus.* On passage from March 22 to 30.

Red-tailed Shrike. *Lanius phœnicuroides.* On March 28 and April 2 a few in the date grove.

Woodchat Shrike. *Lanius senator niloticus.* Single bird obtained on March 19 and 20. Scarce. The previous easternmost record of this bird is from Niriz (east of Shiraz) where it breeds.

Pied Flycatcher. *Muscicapa hypoleuca semitorquata.* On March 22, 1918, I saw a male on board when off Tanb Island ; this is the most eastern record that I am aware of.

Indian Pied Wheatear. *Œnanthe picata.* Noted as fairly abundant on March 27.

Pied Wheatear. *Œnanthe leucomela leucomela.* Obtained on several dates, on March 27 to April 7, presumably on passage.

Isabelline Wheatear. *Œnanthe isabellina.* Fairly abundant up to end of March, probably a winter visitor.

Desert Wheatear. *Œnanthe deserti atrogularis.* Abundant on arrival on March 13 ; probably a winter visitor ; last noted on April 2, Stonechat. *Saxicola torquata maura.* One obtained on March 23.

Redstart. *Phœnicurus phœnicurus mesoleuca.* Obtained on passage on March 23 and 27, both males. The known breeding quarters and winter habitat (Abyssinia, etc.) of this bird lie well to the west of Tanb Island. Blanford did not meet with it in Eastern Persia.

Black Redstart. *Phœnicurus ochruros phœnicuroides.* Several on passage on March 27 to 30. Breeds in Persia.

White-throated Robin. *Irania gutturalis.* A male obtained on March 29 Was the only one seen.

Rock Thrush. *Monticola saxatilis.* One obtained on April 6.

White-breasted Munia. *Uroloncha malabarica.* One obtained on April 7, the only one seen. This bird must, I think, have been a stray ; it may possibly occur further west into Persia than is known. There are two in the British Museum from Muscat collected by Sir Percy Cox, but its occurrence on Tanb is the furthest west that I am a ware of.

Ortolan Bunting, *Emberiza hortulana.* One caught in a rat trap in the date garden on March 27.

Grey-headed Bunting. *Emberiza cineracea semenowi.* One obtained on March 23 on passage. This must be about the most eastern record of this bird.

Black-headed bunting. *Emberiza melanocephala.* Several arrived on April 3 ; the next day a flock of 20–30 (nearly all males) were seen in some new wheat, by April 7 all had gone. The large east to west migration of this species therefore touches this island.

Common Swallow. *Hirunda rustica.* Several seen on April 4, and some passed over to the north on April 14. Apparently only a passage migrant.

White Wagtail. *Motacilla alba dukhunensis.* Plentiful in the date garden and in the lighthouse quarters on March 27. Breeds in Siberia.

Blue-headed-Wagtail. *Motacilla flava beema.*

Black-headed-Wagtail. *Motacilla feldegg melanogriseus.* An arrival of wagtails took place on March 22 and more on the next two days—they frequented chiefly the sandy plain and were gone by March 25. Several specimens of these two forms were obtained of both sexes.

Grey Wagtail. *Motacilla cinerea.* Several with the yellow wagtails were obtained. Tail 100–103.

Tree Pipit. *Anthus trivialis trivialis.* A few with larks on March 29.

Crested Lark. *Galerida cristata* subsp. Resident and common. Unfortunately no series of the Crested Lark was obtained. There are two freshly moulted specimens obtained on September 23, and two worn bleached birds on March 28 and April 2. The former of course are not necessarily the resident bird, they are both males with wing 109–105 which is small for *magna* nor do they resemble *magna* quite in colour. They are darker, not so grey as *chendoola*, though odd ones of the latter race come very near them ; on the other hand I have seen no *chendoola* with a wing as long as 109. They do not appear either to be *tardinata*, not having the breast and back so coarsely marked. The two breeding birds have wing measurements ♂ 104 ♀ 98, much smaller than any *magna*, and they are far more worn and bleached than specimens of *chendoola* are at the same time of year.

Common Bee-eater. *Merops apiaster.* First seen on March 17, two on April 3.

Persian Bee-eater. *Merops persicus persicus.* First noted on April 1.

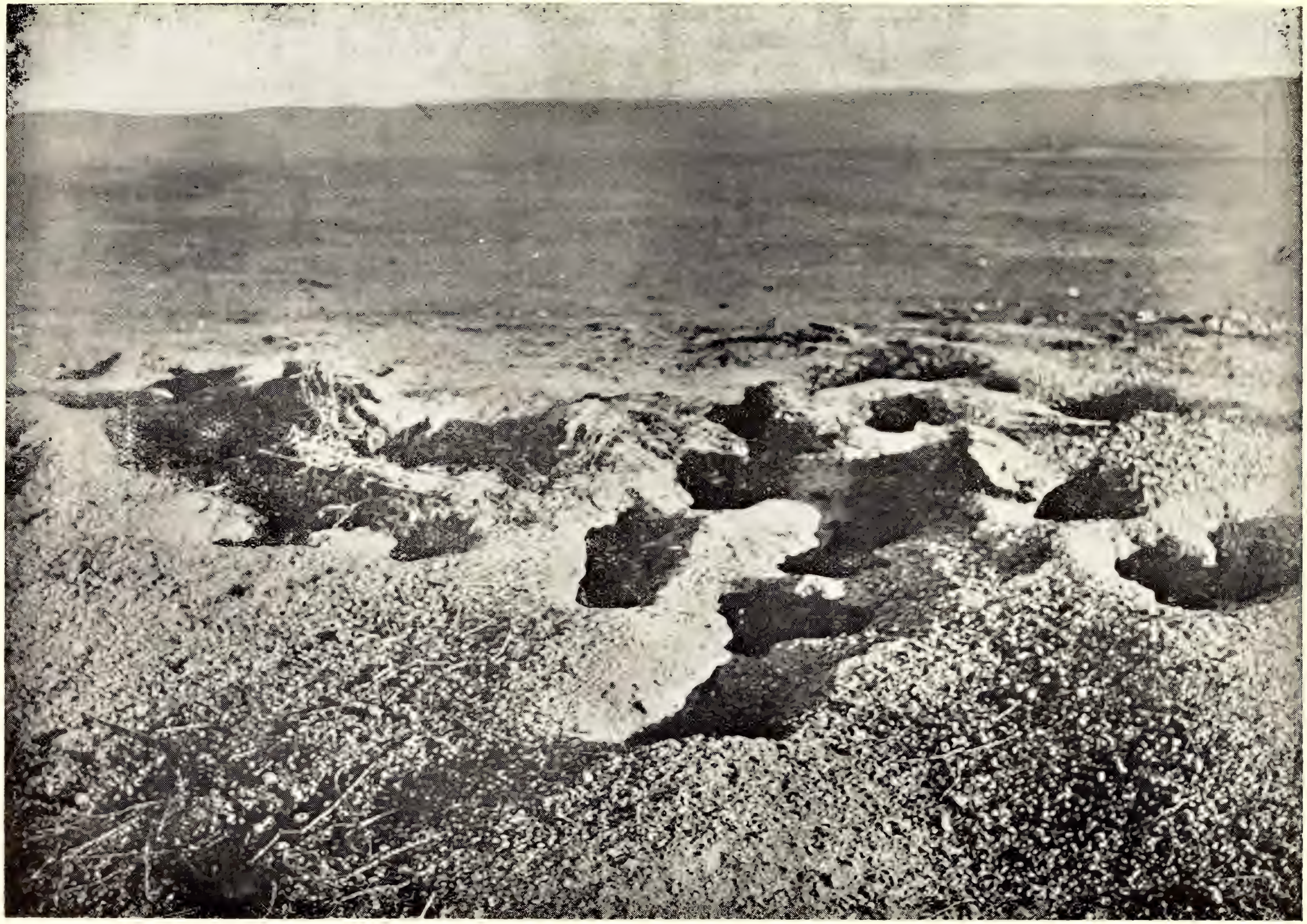
Hoopoe. *Upupa epops epops.* Two seen on March 14.

Pallid Swift. *Micropus murinus murinus.* A flock of about 20 was on the island on arrival and were seen on and off to the end of the month. Status doubtful.

Cuckoo. *Cuculus canorus subtelephonus.* One obtained, a female, on April 13 ; two had been on the island for some time ; a very pale bird with wing 190. From an examination of Central Asian cuckoos I am inclined to think that Zarudny's *subtelephonus* should be recognized : the grey parts are distinctly pale, they are mostly finely barred and have short wings.

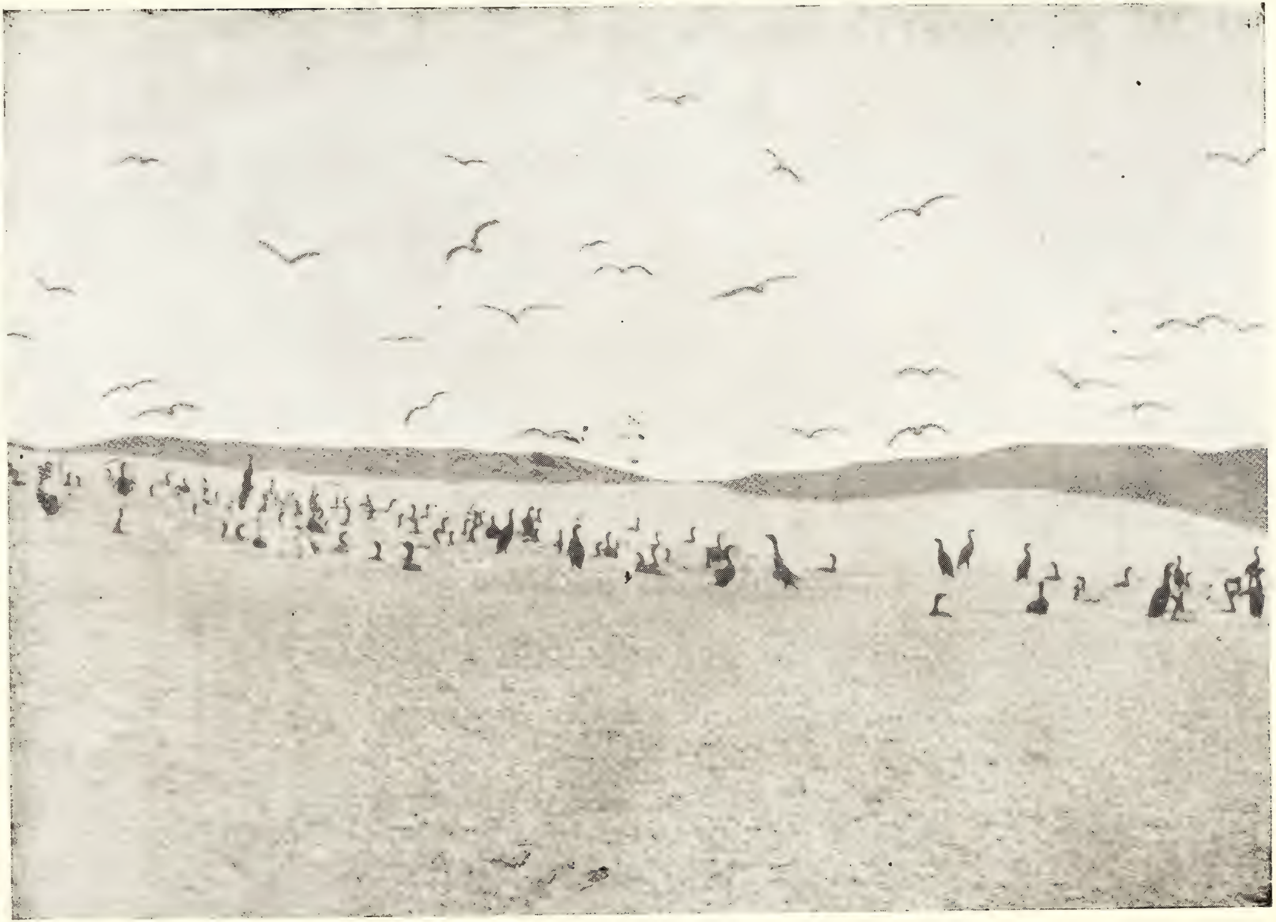
Scops Owl. *Otus scops pulchellus.* One caught on March 20, one on March 16 ; heard on March 24 and 27. Single birds on passage.

Osprey. *Pandion haliaëtus.* A pair frequented the island and were obtained ; the Osprey does not breed on Tanb and the organs of these birds were minute. Another pair however frequents Nabi-u-Tanb and nests on the



The home of a Crab Plover Colony, Warba Island.
May 19, 1907.

(*Photo by Sir P. Z. Cox*).



Cormorants nesting on Halul Islands.

(*Enlargement from a photo by Major R. E. Cheesman.*)

top of the islet (100 ft). Two nests were examined there, both were empty on April 9 and appeared to be alternative nests.

Black Kite. *Milvus migrans.* Two seen on April 11.

Harrier. *Circus sp.* Two seen on September 23.

Kestrel. *Falco tinnunculus tinnunculus.* Odd ones seen from time to time, one obtained on March 26. Probably a winter visitor.

Turtle dove. *Streptopelia* sp. A Turtle Dove was seen on April 13. Probably *S. t. arenicolor* or *S. senegalensis.*

Spotted Sandgrouse. *Pterocles senegallus.* Flock noted several times between March 13 and April 7 ; on being disturbed they flew out towards the Persian mainland and may have been visitors thence. No evidence of breeding could be obtained.

Stone Curlew. *Œdicnemus œdicnemus astutus.* At least one pair resident on the island. A male obtained on March 29 had an incubation patch. W. 225.

Cream-coloured Courser. *Cursorius cursor* (= *gallicus :* auct.). Seen between March 14 and 25. Status uncertain.

Turnstone. *Arenaria interpres.* Flock on the shore during last half of March ; one windswept bird was blown into the loose folds of an Arab's garment and captured.

Grey Plover. *Squatarola squatarola squatarola.* Two obtained on March 20 were the only ones seen. ♂ W. 197, B. 30 ; ♀ W. 191, B. 29. ; obviously belong to the typical race.

Little Ringed Plover. *Charadrius curonicus dubius.* A few inhabited the sandy plain away from the seashore up to April 6.

Kentish Plover. *Charadrius alexandrinus alexandrinus.* Common, resident and breeding. Nest with 3 eggs on March 15, five yards from edge of sea cliff four feet high. Another nest with three eggs was made of a few twigs and a single goat's-dropping in sandy soil amongst short scrub, also near the cliff's edge on March 28. 3 ♂♂ W. 110–115, B. 15·5–17·5 (exp). 7 ♀♀ W. 108–112, B. 15·5–17·5. This series is not distinguishable from a series from Egypt.

Mongolian Sand Plover. *Charadrius mongolus atrifrons.* Winter visitor ; one obtained from a flock September 29 and another on April 11.

Geoffrey's Sand Plover. *Charadrius leschenaultii.* Two obtained out of a large flock on September 23 ; probably also a winter visitor.

Sanderling. *Caladris alba.* A flock frequented the beach most of the time.

Oystercatcher. *Hæmatopus ostralegus.* Flock seen on March 13.

Red-necked Phalerope. *Phaleropus lobatus.* Seen near the island on April 3 and 9.

Hemprich's Gull. *Larus hemprichi.* Three seen, two obtained on Nabi-u-Tanb on April 9. No sign of breeding.

White-cheeked Tern. *Sterna repressa.* Many on the island at the south end on September 23 ; Sir Percy Cox found a colony of 2–300 preparing to breed on the sandy plain on the south-east promontory on May 28, 1905 ; natives say they breed in great numbers. Another large colony were beginning to breed on Nabi-u-Tanb on May 28, 1905. La Personne does not record any terns so that presumably none arrive at the nesting ground as early as April 14. Many breeding on Nabi-u-Tanb on June 30, 1923.

Sooty Tern. *Sterna anæthetus fuligula.* Sir Percy Cox found a colony on Nabi-u-Tanb on May 28, 1905. Breeding there on June 30, 1923 in numbers.

Cormorant. *Phalacrocorax* sp. ? Seen on March 13 near the island.

Tropic Bird. *Phaeton ætherius indicus.* This Tropic Bird does not breed on Tanb itself, but on Nabi-u-Tanb, an islet seven miles west of Tanb ; young and old birds were brought to La Personne by fishermen in the first week of April 1921 and on the ninth he paid a flying visit to the islet. The islet is about a mile in diameter and except for a short beach is girt by high cliffs, which, on their interior face slope down to the centre, forming a bowl where at that time there was a swamp. There are no trees, but there is some scrub on the plain. At the base of the sea cliffs are many water worn fissures, mere cracks at the top and eight inches to two feet wide at the base and going in some six feet some ending in an enlarged chamber ; it was in these fissures that the Tropic Birds were breeding. A good many were seen to be flying in and out of the fissures entering and leaving close to where the fissures met the beach. It seems that only one pair occupied each fissure ; most nesting sites held one young bird but from one two young and a rotten egg were taken as well as a pair of adults. The egg appeared to be a year old, and it is not recorded whether the two young were together or not. The young taken varied in size, a few were just feathering, but most were nearly ready to fly. On March 24, 1923, La Personne paid another flying visit and obtained one egg almost ready to hatch.

The young in down is well covered with greyish-white down, darker grey on the occiput. The young fully feathered resembles the adult except for colour of bill and feet and that the central tail feathers are short and tipped with black. 4 ♂♂ W. 282–295, B. 52–55 (exp.); central tail feathers exceed the rest by 225–235. 5 ♀♀ W. 284–293, B. 52–56·5 (exp.); central tail feathers exceed the rest by 176 (worn) to 235. Bill orange; feet blue and chrome yellow.

In no case were the long central feathers perfect: either one was broken or moulting or missing.

The first absolutely authentic egg ever taken of this bird was one procured by La Personne on April 9, 1921, at Nabi-u-Tanb Island. The ground colour of this egg is a pale reddish cream and it is densely covered all over with freckles and tiny specks of darker reddish brown. Towards the broader end these spots become larger; much more numerous and much darker, forming a blackish red cap at the extreme end, the spots running into one another and forming big patches. The texture, like that of all Tropic Birds, is very coarse, the surface being rough to the touch and altogether glossless. In shape, it is a long and blunt oval, and it measures 58·0 × 42·6 mm.

The other egg in the Cox-Cheesman collection and labelled 'Unknown' is undoubtedly also an egg of this species. It was taken on Nabi-u-Tanb Island on April 23, 1923, and like the last described egg, was very hard set, in this egg the bird being almost ready to hatch. The egg differs considerably from the last. The ground colour is a dull white, only very faintly tinged with cream. The markings consist of deep red—brown blotches, numerous and large at the extreme larger end, very sparse and much paler elsewhere. The texture is the same, but it is a small, proportionately rather broader egg, measuring 54·6 × 41·6.

'I have a third egg of this species in my collection taken by Major Pitman in April on one of the small islands in the Persian Gulf. This is a much larger egg, measuring 64·0 × 48·1, and was not identified by Major Pitman, who thought it might be that of an Osprey laid by accident on the ground. It is, I think, however, undoubtedly the egg of this Tropic Bird. It differs considerably from either of the two eggs already described. The ground colour is dull white, with hardly any markings at all over the greater part of the surface, but with a broad scattered ring of dull light brown blotches and smears at the larger end.'

These three eggs will probably be found to represent the extreme range of colouration in the eggs of this Tropic Bird, and they can be exactly matched with eggs of *Phaëthon rubricaudus*.

Persian Shearwater. *Puffinus persicus*. Seen on March 14 off the island; apparently does not breed on Tanb. The breeding ground remains unknown though it must be in this neighbourhood somewhere. The type was obtained between Gwader and Muscat on February 21, 1872 and is moulting its wings. The only other specimen in the British Museum was obtained between Gwadar and Henjam by Butler on May 17, 1877, when he found it common but very shy. On March 22, 1918, I found it swarming in the Straits of Ormuz and saw one flock of over 200 birds, but saw none west of Tanb. At the same place on November 17, I saw none. Until it can be ascertained what month this bird breeds in it is hopeless to try and find its nesting place.

Reef Heron. *Demiegretta sacra asha*. Two seen. A nest with three eggs was found by Sir Percy Cox on Nabi-u-Tanb on May 28, 1905.

IV. NABI-UL-FARUR.

Is 4 miles long and 2½ broad and rises in dark volcanic hills to a height of 465 feet. The firm belief that this might be the breeding ground of the Persian Shearwater led Sir Percy Cox to send La Personne to investigate the island in 1923. Visited by La Personne on July 6, 1923. 45 miles W. by S. of Tanb Island.

Sooty Tern. *Sterna anaetheta fuligula* and White-cheeked Tern. *Sterna repressa*.

Were nesting in large numbers; eggs fresh. Between this island and

Abu Musa several flocks of Persian Shearwater *Puffinus persicus*, 22–30 in each flock, were seen by Cheesman on March 18, 1921. The birds appeared to be feeding on surface fry.

V. SIR-BU-NA' AIR.

Sixty-five miles south of Nabi-ul-Farur. Visited by Sir Percy Cox on May 29, 1905. Northern half is a waste of volcanic debris ; southern half holds some scanty *salsola* vegetation.

White-cheeked Tern. *Sterna repressa*, Sooty Tern. *Sterna a. fuligula* and Lesser Crested Tern. *Sterna b. bengalensis*. Were seen in numbers, together with a few Large Crested Tern. *Sterna bergii velox* and Hemprich's Gull. *Larus hemprichi*. No birds were as yet breeding.

VI. HALUL ISLAND.

Is 1½ miles long and 1 mile broad and about 115 miles W. by N. of Sir-bu-Na' Air and 75 S. E. of Ras Rakan. Visited by Sir Percy Cox on July 25, 1906 and by Capt. Cheesman, March 19, 1921.

A rocky island with small cone-shaped hills rising to 100 feet, rocks dark red with iron oxide ; at the north end a gravel plain half a mile across ending in small cliffs to the sea ; at the south end there is some scrub (*Halopeplis perfoliata*).

The following birds were recorded :—

Common Wheatear. *Œnanthe œnanthe*. Pied Chat. *Œ. leucomela*.
Blue-headed Wagtail. *Motacilla flava*. White Wagtail. *M. alba*.
Common Swallow. *Hirundo rustica*. Red-rumped Swallow. *H. rufula*.
Tawny Pipit. *Anthus campestris griseus*. Sand Martin. *Riparia riparia*.
Hoopoe. *Upupa epops*. All halting on passage March 19, 1921.
Tropic Bird. *Phaeton indicus*. Three seen on March 19.
Black-headed Gull. *Larus ridibundus*. Few.
Slender-billed Gull. *Larus genei*. Thousands ; on March 19.

Lesser Black-backed Gull. *Larus fuscus taimyrensis*. A good many round the island ; these birds appeared over the cormorant colony as soon as the latter were disturbed, swooping down to devour eggs and chicks as well as regurgitated food thrown out by the young and the parent birds.

White-cheeked Tern. *Sterna albigena*, Sooty Tern. *Sterna a. fuligula* and Lesser Crested Tern. *Sterna b. bengalensis* are recorded by Sir Percy Cox on July 25, 1906, but apparently their eggs had been recently taken by Arabs. Cheesman saw many terns off the island during his visit.

Osprey. *Pandion haliaëtus*. Two pairs were breeding during Cheesman's visit ; from one nest the young had already flown and the youngsters were found on the shore. The nest was situated on the top of a cone-shaped hill and held only fish remains and remains of young cormorants. The other nest, also situated on a cone-shaped hill, held two young almost ready to fly. The nest was made of sticks of a dead salt bush (*Salsola* ?) and was about 1 foot thick and 5·6 feet across ; by the nest were the remains of a tern, a slender-billed gull and fish. On January 21, 1919, Capt. Poyntz, R. I. M., took 3 eggs from one of the nests. Another disused nest was probably an alternative site.

Socotra Cormorant. *Phalacrocorax nigrogularis*. The most interesting discovery made during the exploration of the Persian Gulf Islands was the finding of the breeding quarters of this cormorant. This species was first discovered on the island of Socotra on December 7, 1898 (see *Birds of Socotra*, p. 49) since when little or nothing seems to have been published about it. On March 19, 1921, R. I. M. S. 'Nearchus' anchored off Halul Island and Capt. Cheesman was able to go ashore. Ten miles distant from the island a thin cloud of Cormorants could be seen wending their way towards land and from the numbers subsequently seen it was surmised that a vast colony must here exist. Capt. Cheesman timed one flock which was leaving the island for the fishing grounds and found it took 8 minutes to pass a fixed point at the rate of 20 per second—roughly 10,000 birds in a flock. The colony was located on the gravel plain at the north end with no difficulty—indeed it could be smelt half a mile away ! Here cormorants were standing about like black ninepins in thousands while another army were esconced on the cliff's edge. On being disturbed the colony began to walk towards the sea, some rising on the wing after a clumsy run, a few remaining on their nests till approach was made within 30 yards. No sooner had the cormorants departed than fifty Black-backed Gulls (*L. taimyrensis*) appearing from nowhere swooped down to seize such eggs and young as they could and to gobble up the fish ejected by the frightened parents and young. The nests were either scratched depressions in the gravel or slightly raised above the surface, no material but gravel being used ; the nests almost touched each other, some contained three eggs, some two or only one, while others had young in all stages. The young, blind and naked at first, later on when they can walk get a coat of white down. Two birds shot off the nest proved to be males.

The adult has the feet and gular pouch black, iris green, bill black. An immature bird (a year old ?) has the feet pink-brown, iris whitish, gular pouch pinkish, bill light brown to bluish. The nestling is covered with pure white down except round the eyes and upper part of neck and gular region ; the iris is pinkish white, legs and feet ivory white.

It is very remarkable to find that the chick of the cormorant has white down as those of *carbo*, *javanicus* and *graculus* have dark brown or black down.

Whether this Cormorant nests on Socotra and intermediate islets between the Persian Gulf and that island or is only a non-breeding visitor there remains to be seen. Capt. Cheesman probably hit off the tail end of the breeding season on Halul as the Captain of the ' Nearchus', Capt. Poyntz, visited the island on January 21, 1919 and found multitudes of eggs and young, but at the end of April 1920 no birds were to be seen there. Moreover by March 19, Cheesman found many young on the wing.

Measurements of 3 ♂ ♂. W. 285 (worn) 297, 289 ; Bill from angle 74, 73, 71 ; Ts. 73 ; Md. toe with claw 93.

According to Ogilvie Grant the three Socotra birds in the British Museum measure ♂ W. 298–310 ; ♀ 275 mm.

The eggs of this bird are probably the most interesting in many ways taken by Sir Percy Cox and Major Cheesman, and form a most remarkable variation from any previously known eggs of cormorants or darters. In ground colour they are a pale blue similar to all other cormorants' eggs and like the latter are normally covered all over with a heavy deposit of calcareous matter, though in many cases this is not nearly so thick as it is in most birds of this genus. In a few the deposit is almost wanting.

Unlike all other birds of this genus, or indeed family, there are well-defined dark amber brown blotches for the most part confined to the larger end, but in some equally, though sparsely, distributed all over the egg. These markings, although in many instances concealed or semi-concealed by the lime deposited over them, are the same as primary or superficial markings on the eggs of other birds. In some cases there are also subsidiary undersurface markings which appear to be a pale neutral tint, or grey, though if sufficient of the shell is scratched off, they would of course appear to be amber brown like the rest.

The eggs do not vary much in size, ranging between 53·6 by 34·6 and 48·7 by 33·5, and in breadth between 50·1 by 33·1 and 52·0 by 36·0 mm. An egg in Mr. Jourdain's collection from some island in the Persian Gulf is larger, 56·7 × 37·4.

VII. Farsi and Arabi.

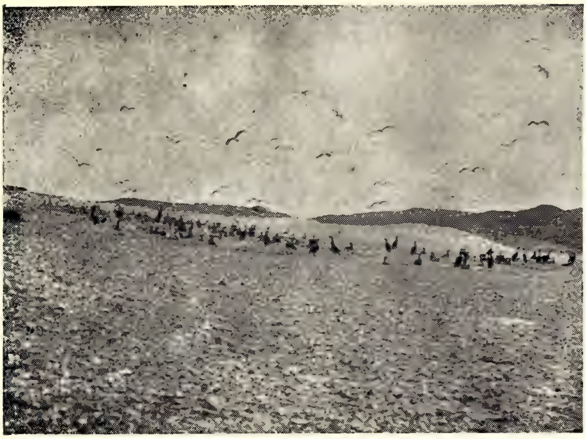
Two island sandbanks 10 feet and 3 feet respectively, above high water, about fifteen miles apart, situated almost in the centre of the Gulf between Bushire and Ras-al-Bidya on the Arabian Coast. Visited by Lapersonne April 23, 1921.

Farsi.

The more northerly of the two and the larger, consists of about 5 or 6 acres of sand with a fringe of rocks off the north beach. There is some low vegetation in the centre and the south end.

Terns and cormorants were seen and the latter evidently bred there. Several halting migrants were seen and the following species obtained :—

Rock Thrush. *Monticola saxatilis*, Blue-headed Wagtail. *Motacilla flava* sub. sp., ♀ ; Common Redstart. *Phœnicurus ph. phœnicurus*, Bluethroat, *Cyanosylvia suecica magna*. Common Roller. *Coracias garrula semenowi*, Scops Owl. *Otus scops pulchellus* ; Black Kite. *Milvus migrans* and



Cormorant (*Phalacrocorax nigrogularis*) Colony on Halul Islands.

Gulls waiting overhead to prey on eggs when Cormorants leave.

(*Photo by Major R. E. Cheesman*).

Young Cormorants (*P. nigrogularis*) in white down on Farsi Island.

(*Photo by Lt. Hindman, R.I.M.*)

BIRDS OF THE PERSIAN GULF ISLANDS.

Young Ospreys
in nest.
Halul Islands.

Site of Osprey's nest on Halul Islands.

(*Photos by Major R. E. Cheesman*).

Kestrel. *Falco tinnunculus* were also seen. In 1878 Col. Butler received many eggs of *Sterna bengalensis* from an island ' close to Arabi.'

Arabi.

Is a sandbank fringed with rocks just above sea-level, and is only 100 yards square ; it has no vegetation.

A few Terns and Cormorants were seen and they are said to breed ; numbers of dead young Cormorants were found on the beach. The following passage migrants were obtained :—

Ortolan Bunting. *Emberiza hortulana,* Rock Thrush. *Monticola saxatilis.* Eastern Turtle Dove. *Streptopelia turtur arenicolor,* Nordmann's Pratincole, *Glareola nordmanni.*

VIII. UM-AL-MARADIM AND QARU.

Visited by Sir Percy Cox on June 11, 1905.

Um-Al-Maradim. A sand islet situated about 20 miles off the Koweit Coast about half mile in extent, 20 feet high and covered with scrub. White-cheeked, Sooty and Lesser Crested Terns, *Sterna repressa, S. ancætheta fuligula,* and *S. b. bengalensis* were found nesting. Here and there among small colonies of *bengalensis* was a nest of *fuligula* under any little bush which happened to be in the former's territory. In one or two cases a small colony of *repressa* were nesting in the middle of colonies of *bengalensis.* A small group of Crab Plover, *Dromas ardeola* were seen and corpses of young Cormorants were found.

Qaru.

An islet about 15 miles north-east of Um-al-Maradim. The same terns were seen on this islet, but it was apparently not used as a breeding ground. A flock of Cormorants were seen and the island was strewn with dried-up corpses of half—grown young.

IX. KUBBAR.

A small sand islet 8 feet high and covered with scrub. Situated about 30 miles north of the last group and about 20 from the Koweit Coast and 32 from Koweit. Visited by Sir Percy on Cox June 9, 1905 and by La Personne on April 24, 1921.

Sir Percy Cox found the following :—

White-cheeked Tern. *Sterna repressa.* Small separate colonies in the open ; some attempt was made at a nest ; two eggs seemed the usual number and they varied much in colour in the same nest.

Sooty Tern. *Sterna ancætheta fuligula.* Breeding in small colonies and also scattered singly all over the island.

Lesser Crested Tern. *Sterna bengalensis bengalensis.* Breeding in numbers.

La Personne found :—

Crab Plover, *Dromas ardeola.* Many holes on the higher ground and a flock was seen.

Reef Heron, *Demiegretta sacra asha.* Six or eight nests, these consisted of twigs placed on masses of weeds a foot and a half high. The nests contained 3 to 4 eggs.

X. AUHAH.

Situated 3 miles off the south-west of the inhabited island of Failakah which is at the entrance to Koweit Bay. A rocky islet reduced at high water to an area of 200 × 300 yards, there is little or no scrub. Visited by La Personne on June 12, 1923.

Crab Plover. *Dromas ardeola.* Breeds in numbers. The parent birds were seen carrying pulped crabs to young in the holes ; the young in down walk with difficulty and make a noise like the young of chickens.

Squacco Heron, *Ardeola ralloides.* One obtained on passage near Auhah on April 25, 1921.

White-cheeked Tern. *Sterna repressa.* } Breeding in great numbers.
S. b. bengalensis. }

Sooty Tern. *Sterna a. fuligula.* Nesting in disused holes of *Dromas ardeola,* the single egg being placed about six inches down the hole. The eggs were fresh.

Houbara. *Chlamydotis houbara macqueeni.* One seen by Capt. Cheesman off the Shat-al-Arab bar flying north on November 5, 1923.

A NEW SNAKE FROM BURMA

BY

COL. F. WALL, C.M.G., K.H.S.

Among a collection of snakes from Huton, Kachin Hills (4,500 feet) aggregating 79 specimens, received recently through the kindness of the Rev. Father Gilhodes, I find three specimens of a species of *Rhabdophis* hitherto indescribed, which I propose to designate.

Rhabdophis speciosus sp : nov :

TYPE. ♂. 805 mm. (2 feet, 7¾ inches), the tail 218 mm. (8¾ inches).

GENERAL CHARACTERS. Snout, moderately declivous, moderately narrowed. Nostril, moderate, situated in both nasals, and occupying the 2nd and 3rd fifths of the nasal suture. Eye, large, its diameter equals its distance to the anterior edge of the nostril. Pupil round. Neck, moderately contracted. Body, moderately robust, cylindrical. Tail, rather long.

LEPIDOSIS. *Rostral*—Rostro-nasal sutures rather longer than the rostro-internasals; portion visible above about half the suture between the internasals. *Internasals*, two; the anterior border about two-thirds the length of the posterior border; the suture between them a shade less than that between the praefrontal fellows. *Praefrontals*, a pair. *Frontal*, a shade longer than the snout. *Nasals*, two. *Loreal*, about three-fifths the length of the nasals. *Præocular*, one. *Postoculars*, three. *Temporals*, two anterior. *Supralabials*, eight; the 1st and 2nd touching the nasals, 4th and 5th the eye, and the 6th and 7th the anterior temporals. *Sublinguals*, two pairs, the posterior rather longer than the anterior, separated by three azygos and a pair of scales, behind which is the narrow first ventral. *Infralabials*, the 5th, 6th and 7th touch the posterior sublinguals. *Costals*, in 17 rows two head-lengths behind the head, 19 at midbody, 17 two heads-lengths before the vent. About three heads-lengths behind the head a new row of scales appears on each side of the vertebrals. The rows remain 19 to about four or five head-lengths behind midbody when the fourth row above the ventrals disappears. Keels present in all rows at midbody. Apical facets in pairs, very distinct. Apical emargination present. The scales of the vertebral row are about half as broad as their length, and half the breadth of those in the ultimate row. The scales in the ultimate row are not quite as broad as long. *Ventrals*, 166, the two first narrow. *Anal*, divided. *Subcaudals*, 87, paired.

COLOUR. Dull olive-green dorsally, with a series of closely set; vertical pale spots on the 4th and 5th rows above the ventrals, continued well down the tail. A fairly distinct chequering of blackish and ochraceous yellow spots in the anterior part of the body, and a bright ochraceous bar across the occiput, a little behind the parietal shields. Belly dirty whitish, peppered with black and grey spots, denser on the basal parts of the ventral and subcaudal shields, and in the posterior part of the body. Anteriorly this peppering is chiefly lateral. Head olive-brown above merging to dirty white on the lip. The posterior edges of the supralabials dark, black and conspicuous on the 5th and 6th of the series. Lower lips and sublingual region palest buff, immaculate.

DENTITION. From specimen No. 3. *Maxilla*, carries 29 teeth. Diacranterian. The praecranterian 27, anododont, isodont. Cranterian 2, obliquely set and fully twice the length of the preceding. The praecranterian space would accommodate one tooth. *Palatine*, 19 left, 20 right; anododont, isodont, not quite so long as the maxilla. *Pterygoid*, 26 left, 27 right; anododont, isodont; about as long as the palatine. *Mandibular*, 31 left, 32 (33?) right; anododont, kumatodont; the median as long as the maxillary.

REMARKS. Specimens 2 and 3 agree with the type except that the ventrals number ♂ 168, ♀ 167; and the subcaudals ♂ 86, ♀ 87. The number of costal rows anteriorly is very unusual for a species of this genus. Specimen 2 is a ♂ 710 mm. (2 feet, 4 inches) long, the tail 188 mm. (7 inches). Specimen 3 is a ♀ 622 mm. (2 feet and ½ an inch) long, the tail 168 mm. (6 inches).

AN ORIENTAL HUNTING WASP *SPHEX LOBATUS*

BY

MAJOR R. W. G. HINGSTON, I.M.S.

PART I

GENERAL HABITS

Home of sphex—Her appearance—General habits—Manner of hunting—Excavations—Expulsion of cricket—Mode of battle—Storing of victim—Application of egg.

I recall a wide expanse of river-bed. It is a mere neglected sandy plain, a dusty waste, swept with ripples, fissured by the sun, and thirsting for the vivifying rains of summer to inundate its crumbling soil. Rank weeds are rooted in its ruts and furrows, a coarse and brittle jungle-grass clothes it in a withered scrub, while here and there some hardy tamarisk adorns it in a more luxuriant garb. For four months in the year it is a waste of water, caused by the floods of the neighbouring river that submerge it at the time of the monsoon. But at other periods it is a sun—baked plain, a broad wilderness of desiccated sand.

This is the type of district beloved of the sphex. The blazing sun of early May, the crumbling, coarse and parched soil, the sands that burn to the human touch, these are the particular attributes of Nature in which this solitary wasp delights. Let us seek her when the sun stands high in the heavens, for it is then that she rejoices at her work. Nor is the beauty and the splendour of her colouring out of harmony with the full blaze of light.*

The species I refer to is the *Sphex lobatus*, a sparkling gem of metallic splendour not uncommon on the Indian plains. She is to be found throughout the whole of the peninsula, and also in Burma and Ceylon. To the east she extends to China and the Malayan region ; to the west into the continent of Africa.

Let us glance for a moment, in a little detail, at the glorious magnificence and beauty of her dress. Her head is in the form of an oval disc that looks forward from a narrow neck. It glistens with a brilliant metallic green ; round about the ocelli there is a gleam of yellow, and on either side are the large black eyes. From in front project the sensitive antennae, delicate elastic—jointed rods that naturally assume a spiral turn, while below are the toothed and intercrossing jaws, each with its sickle-shaped point. Her stout thorax gleams with the iridescence of the head. Behind it is adorned with fine transverse lines that seem to strengthen the lustrous glow ; in front it is a pure and polished green with evanescent tints of gold. The same splendour is extended even to the thread-like waist, and the conical abdomen is a dazzling sheen, a mingling of yellow and blue and purple and gold according to the angle of the light. Her long scintillating wings give forth a reddish gleam and terminate in purplish tips, while her legs, well armed with numerous spines, are refulgent in green and blue. In body length she is exactly one inch, and her showy integuments are like an armour, for they are as solid as a coat of mail.

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* Naturalists interested in the hunting-wasps will find the habits of the following species, *Ampulex assimilis Psammochares metas*, *Cryptocheilus rubellus*, *Psammochares rutilus*, described in detail *Nature at the Desert's Edge*, Witherby and Co., 326 High Holborn, London.

A record of the operations of this Indian sphex is a piecework of scattered facts. She wanders alone on the sandy waste without any settled abode. We are sure not to find her at the time we want her ; then suddenly, at some unexpected moment, she happens to cross our path. Nor is she so common as to be daily encountered, at least in this neglected tract. We must make the most and best of every opportunity and patiently depend on chance. On each occasion she will tell us something fresh about herself, and by blending the records of these accidental meetings we will learn the details of her work.

A tireless industry, an incessant activity, an outburst of glowing energy and enthusiasm when approaching the object of her desire, these are the most striking features in the disposition of this hunting-wasp. She is naturally timid except when busily engaged. Her powers of vision are excellent and she sees an intruder from a distance. On his approach she either immediately takes to her wings, or, if engaged at hunting, she will just flit away a little distance and wait until the object that disturbed her has passed. She needs the glare of sunlight for her work. It is then that we find her feverishly digging in the soil, but when the clouds appear she seeks seclusion. I then see her hiding in the midst of the tamarisk, clinging motionless to a cluster of leaves. She is strictly solitary in her general habits : her explorations, her excavations, the slaying of her victims are always conducted alone. At only one time do I see a trace of any social instinct. It occurs at the close of the day's work. The sphex then retires to the shelter of the tamarisk where she prepares to spend the night. I sometimes see three or four of them in the same bush, often hidden in the densest part and fixed to the stems and leaves. It is the only indication of any feeling of companionship in their otherwise solitary lives.

As a rule we will encounter her when seeking her prey. In the reproductive season the greater part of her time seems to be spent in the labours of the chase. The object of her search is the *Brachytrypes achatinus*, a stout-built cricket of great strength and unusually massive size. Its body is a smooth and shining brown that passes into yellow beneath. Its huge head presents a formidable appearance. On either side are the piercing coal-black eyes ; between them the projecting filiform antennae, and below the sharp and rigid lip that protects the thick grinding jaws. The sphex will not find this monster on the surface ; it lives in the bottom of a deep burrow from where it emerges only by night. Its capture necessitates a long search followed by a slow and laborious excavation into the depths of its subterranean retreat.

She confines herself strictly to this one species. For some reason the *Brachytrypes*, and this kind alone, is best suited for the purpose in view. There are numerous other kinds of crickets that inhabit this soil. Some live near the surface or just under the clods and she could take them with the greatest ease. But she despises all the smaller and more common kinds ; she must have the great monster beneath.

The *Brachytrypes* is most partial to the sloping ground at the margin of the river-bed. It seems to like those places where the once swollen river touched upon the shelving bank. This, therefore, is the ground best suited for our purpose. If gifted with patience, we may here disentangle the successive stages in the operations of the sphex. Here she comes, like a green sparkling gem, hurrying over the dusty soil. She runs in and out amongst the tussocks of grass, round about the thicker stumps of the tamarisk, then out upon the open space of hot and crumbling sand. Her golden wings are constantly quivering, and those wonderfully sensitive points, the antennae, are perpetually touching and testing the soil. She is systematic in all actions, and maintains a constant and persistent search. She explores little hollows, plunges down into tunnels and thoroughly investigates every place she meets. She gives most attention to the gloomiest nooks, to the depths of the burrows, to the under surface of the clods ; no likely spot is passed unnoticed ; nothing is missed in her untiring search. Here and there she scuffles a little in the soil as though she imagined that something lay hidden beneath. At times she digs a little deeper, perhaps down to the base of her wings. But the excavation usually results in nothing; she expends in this way much fruitless effort and then runs off to repeat the process elsewhere. At other times she is more persistent in her excavations ; she returns to the same place again and again, as though she felt that, in spite of failure, something must surely lie buried beneath. But in the end she will usually desert this spot also, often rising on her powerful wings and disappearing in a green flash of light.

At length she will find some spot of particular interest. Instead of just a few casual shuffles she will burrow excitedly into the soil. Let us now watch her with a little care. We will probably be not alone in our attentive observation ; there is frequently another creature watching her too. A little fly is hovering stationary in the air. It has fixed her with its penetrating eye. It holds itself at a height of about a foot above her and a similar distance behind. From its ærial watch-tower it follows every movement ; it advances when she advances ; it turns when she turns ; if she stops to dig, it just hovers in its place giving forth a gentle hum. It always holds itself at the same distance from her and follows her wherever she goes. Thus together we watch the operations. Both of us are eager, though for different reasons, to witness the fulfilment of the work.

The soil is ideal for the purpose of excavation, being loose and sandy and easily thrust aside. At first she may hesitate as to the best place to dig. As a consequence she often scuffles in three or four places before she alights on the exact spot. At length, having found it, she bursts into enthusiasm. Before her lies a mound of upturned soil, ejected debris scattered on the surface which has been thrown up from some cavern beneath. Into this she plunges, raking and scuffling ; she must know that the object that calls forth such energy lies buried deep down in the earth. She is an expert in the art of mining operations. Her excavation advances with great rapidity and in a minute or two she has shaped a hollow in the sand. Any obstructing herbage she thrusts forcibly to one side. With her fore legs she rakes back the looser debris, working them alternately with such energy and speed that the sand is shot backward jet after jet in an almost continuous stream. The spouts issue forth between her hind legs like a miniature volcano of dust. She employs her mandibles for the coarser work. With these she tears away the roots and the stems, hoists out the bulkier nodules of earth and drags them to the mouth of the hole. Often she is not satisfied at just leaving them near the entrance ; the larger pieces, the clods, which to her must be enormous boulders, the stems, which in proportion are like trunks of trees, these she designedly drags farthest away so as to prevent them slipping back again into the hole. Thus she advances by raking and digging. Whatever obstructs her she breaks it down, applying to it her jaws or her vertex or her legs.

As she descends she has not only to eject the soil, but she finds that the material shot backward between her legs tends in part to fall back on her again. A loose hillock of debris accumulates at the mouth which threatens to collapse into the hole. She realizes the danger and takes steps to meet it. At intervals she backs upward out of the burrow, ascends the hillock, scatters back the dust until it is swept clear of the hole. Then she immediately plunges back into the tunnel, and soon digs herself down out of sight, though the signs of her excavation are still apparent from the succession of jets that come shooting from the hole.

At length the volcano suddenly ceases. We no longer see the sphex backing up to the surface, and the work of excavation seems to have come to an end. She has broken through the barrier that obstructed the gateway and is now in the cricket's den.

For a variable time everything is silent. It may be half a minute ; it may be a minute or more before the next step in the drama occurs. Then a huge head appears at the aperture. Two glaring eyes peer forth into the open and two long antennae are thrust through the gate. The brown fleshy body quickly follows, and soon the whole of the enormous cricket emerges with a sudden rush. Close upon its heels comes the excited wasp, mad with enthusiasm, her colours flashing as though the ardour of the chase had added to her sheen. In a few swift leaps the cricket is away, with the mouth of the burrow a yard or two behind. For a moment the wasp may be temporarily at fault. She rushes about in search of her quarry, sometimes hunting in the wrong direction, but soon she finds the track of her spoil. Then commences the chase in the open. The sphex, all aglow with excitement and anger, pursues her quarry with a passionate rush. Away goes the cricket leap after leap, and after it the murderous sphex. She reaches it, comes up from behind it, for she dare not face its powerful jaws. She clutches at it ; there is for a moment a swift and disordered scuffle, but the cricket manages to break away. The chase continues ; the cricket makes a longer leap than usual, with the result that the sphex for a moment loses it, but she soon recovers the trail. Again she seizes it ; this time her grip is rather more secure, and she makes an effort to apply her sting. The moment, however, has not yet come : the cricket a second time struggles from her grasp, again it breaks into a succession of leaps, but the wasp is now close up behind it, soon she has it gripped for the third time and the cricket is now doomed. This time she clutches it firmly by the back. She fixes her mandibles on one of its wings, she clings onto its body with her curved claws, she curls her abdomen round one of its flanks and thrusts the tip underneath its chest. Immediately she attempts to sting her victim ; two or three times we see her pointed spear project, but the thrusts which she gives it are so quick and sudden that we cannot tell if it is driven home. Soon, however, she changes to a steadier operation. She presses forward her abdomen right under the thorax until its point is almost at the cricket's head, then out comes the long and quivering sting which she plunges into the cricket's neck. This is quite different from her previous efforts. It is not just a sudden, almost instantaneous, act, the mere insertion of the spear for a moment after which it is as quickly withdrawn. This is a long and steady and determined effort. For half a minute she remains thus locked with her victim, her body curled around its flank and her sting embedded in its neck. She makes not a movement of any kind, with her claws and her mandibles she just maintains a grip while the deadly poison takes effect.

In this one stroke the battle is finished. This last thrust secures immediate conquest, but, in order to be effective, it must be perfect and precise. It is not easy for her to achieve this final stroke, hence it is that the cricket so frequently escapes. The wasp must first adjust herself round the flank of her victim, gain a suitable purchase with her claws and mandibles, before she can apply her sting. It is difficult to do this with a struggling victim, and thus the cricket often manages to shake her off. But once the final plunge is made, once the tissues of the throat are pierced, then the struggle is instantaneously ended and the cricket rolls over in a helpless heap as though it were struck dead. Its legs fall, its antennae droop, it lies on the sand without a trace of motion, to all appearances a lifeless thing.

The sphex now steadily withdraws her weapon and awakens from that fixed immobile attitude which held her while her thrust was being driven home. She scarcely waits a moment ; she seems to know clearly that her conquest is complete. Getting astride her victim, she seizes it by the antennæ and immediately commences to draw it away. I take the prostrate victim from her jaws. To all appearances it is absolutely dead. Not a heave of the body, not a tremor of the limbs, even the antennæ hang limp and motionless ; the cricket, in fact, is so completely paralyzed that it shows not a trace of life.

Let us pause for a moment over some details of this contest ; it is the most important and exciting episode in the life of this animated sphex. The battle is by no means a one-sided affair with certain victory assured to the wasp. The cricket is not lacking in the capabilities of defence. Though its fleshy body is deficient in armour, yet it is supplied with powerful instruments of battle and is superior in muscular strength. Its hind thighs are stout and fusiform-shaped rods that can kick with tremendous force, while the shanks are armed with double rows of backwardly projecting spines. Its mandibles are massive triangular structures, each being obliquely cut into a curve and fixed on a pyramidal base. Their opposing surfaces are sharpened to an edge, their extremities terminate in in-turned points, and the cutting margins are suitably provided with blunt and jagged teeth. Such are the weapons that the wasp must circumvent before she can apply her sting.

We will see that the cricket in the final struggle can sometimes use these weapons to effect. Six times have I been witness to the expulsion of the monster; on five occasions the fascinating contest followed, not brought about by any artifice of my own, but a battle fought on the open sand in a free and unfavoured field. Four times victory fell to the wasp; twice the cricket escaped. The first conflict was that which I have just described and is typical of the general character of the fight. On the second occasion the tables were turned. The sphex managed to come upon her victim clumsily. Instead of approaching it skilfully in the rear, she happened to advance with a rush upon its head, and, instead of getting her sting underneath the thorax, she drove it against the cricket's face. This was a fault in fundamental tactics; it was probably due to a simple error, since the cricket at the time lay crouching on the sand and the wasp must have mistaken its head for its tail. Her adversary instantly seized the advantage; it closed its massive jaws upon her leg and held her with a firm grip. She drew back in a frenzy, dragged and struggled, and at length managed to tear herself away. But she clearly had received the worst of the tussle. For a little while she lay half collapsed on the ground, then walked slowly and haltingly off, and refused to come again to the fight. Through the clumsiness of her attack the cricket had conquered; nor was it at a loss to make the most of its advantage, for it left the arena in a few hurried leaps and soon dug itself into the sand.

On the third occasion also the cricket escaped. This time it did not gain the victory in battle; it eluded its pursuer by the strength of its legs and the rapidity of its successive leaps. Its first jump carried it far from the burrow, after which it did not rest till it was yards away, with the result that the wasp on coming to the surface was unable to take up the pursuit.

The fourth was one of the deadly contests. This time the wasp at her first grip got a hold of the cricket by a hind leg. Then very deftly she worked herself forward until she obtained the usual purchase on a wing. Again I observed the same detailed operations, the adjustment of the sphex to the cricket's flank, the few preliminary strokes underneath the thorax, and then the final deadly thrust straight into the victim's neck. The one detail of the operation that still remained uncertain was the nature of these swift preliminary strokes. Are they actual poisonous thrusts,

1927
ONAL MUSEUM

genuine stings which penetrate the integument, or are they mere external probings which fail to be driven in? They are quick and sudden and utterly unlike the prolonged thrust that finally quells the struggles of the prey. In this contest they scarcely seemed to pierce the body, nor did the cricket seem much the worse for their effects. At first it appeared as though they were not real stings, but the searching and probing of an excited sphex eagerly feeling for the point at which to strike.

On the fifth occasion I saw only one preliminary sting. The wasp first gripped her victim by a hind leg, then, bending forward beneath its body, drove her lance into the abdominal mass. After this she took her customary hold upon a wing and plunged her sting into the tissues of the neck. Thus the preliminary stinging is variable in position and number; it is the final act that never fails.

The sixth contest disclosed additional variations. It was a battle greatly to the advantage of the sphex, for she had fallen on her victim at the mouth of the burrow when it was entangled in a tussock of grass. I here had a good view of the preliminary perforations. Three times I saw her thrust her sting into the thorax, after which she made a fourth stab into the abdomen, followed by a fifth into the side of the chest; then she came forward into the final position in order to reach the neck. The cricket seemed injured by these five preliminary stings, not, however, to any very great extent. The stab had to be made deep into the neck before quiescence occurred.

With the help of the records of these successive contests we can summarize the deadly strategy of the sphex. Her first grip is usually made on the cricket's hind leg, and the wasp, without waiting another moment, immediately applies her sting. Her first thrusts are merely of a preliminary nature; they are swiftly made, rapidly repeated, vary from about two to five in number, are applied to the under-surface of the thorax and abdomen, and, though they impede the cricket to some extent, yet they fail to produce a condition of paralysis, because they just penetrate the surface integument and do not reach the nervous chain. Thus, these preliminary stings are auxiliary blows; they are given in order momentarily to stagger the cricket and so enable the wasp to curl herself forward into the position for the final stroke. The last thrust is utterly different from the rest. The plunge into the neck is the blow of victory; it is from this alone that helplessness results.

The cricket, being vanquished, must next be removed. The wasp stands astride of it, her legs wide apart. She seizes the thread-like antennæ in her mandibles and walks her burden over the sand. It is a heavy load to which she has applied her strength: the monster may appear eight or ten times her size, yet she drags at it impetuously, hauling it over the leaves, round about the loose clods of earth and through the stiff stems of the grass. She makes no attempt to raise her victim. Her wings may vibrate with excitement or anger, but so massive a burden makes flight impossible, so she is compelled to keep her transportation to the soil. If the cricket is small and satisfactorily paralysed, she can move it along at a walking pace. But if it is large or has some power of movement, then she may burst into a frenzy of passion, seize it by the throat, crush it with her mandibles and tear apart the tissues of its neck. This is, however, not a general occurrence, it is but a rough accessory to the more perfect operation, and is usually reserved for a victim that is regaining its strength before she has time to bury it underground.

She drags it off to the burrow from where it was expelled. It may be a journey of only a foot or two, but, on the other hand, it may be a tedious business if she has been involved in a difficult chase. When she reaches the gateway she thinks of storing her burden. Now she may often desert it for a little while ; she may either have some difficulty in finding the entrance or she may pay a visit to the interior of the tunnel to see if it is suitably prepared. At length she returns, finds her burden at the place where she left it, and then drags it to the edge of the gate. She places the cricket in such a position that its head is turned towards the entrance of the shaft. Again the sphex enters and for a moment disappears. Almost immediately she returns, takes hold of the cricket by the antennae and pulls it head first into the tube. For about a minute she remains below ; then, on emerging, she takes a stand over the entrance, shuffles back the sand into the tunnel and thus seals the open gate. This last is a rapid and skilful operation: the soil is loose and she is an expert at the work. In a few minutes the gateway is sufficiently closed, and, satisfied with this, she disappears.

Let us now investigate what has happened within. I follow down the tunnel into the sandy soil. It is a straight tube, slightly oblique in direction, and about equal to a middle finger in width. Its upper portion lies in the crumbling sand, but its lower half enters a more compact stratum which is pleasantly moist and cool. After tracing it down for fourteen inches I come upon the blind end. There is no special dilatation to be seen, nothing in the nature of an artificial chamber ; it is merely a straight blind tube. The cricket is crouching at the bottom of this tunnel. It is seated with its head looking towards the gate. I expect to find it paralysed and helpless, for such it was when being dragged in. But it is seated erect looking out through the tunnel. I disturb it and it advances, coming forward on to the upturned soil. This, indeed, is a surprising resurrection. It took scarcely fifteen minutes to uproot the burrow, yet in that time the cricket has thrown off its stupor and returned to vigorous life. It is certainly enfeebled to some degree, but, on my interference, it goes off with a rush, its antennae quiver, its body pulsates, it can run and leap and make good efforts to escape ; moreover, when I capture it to bring it back to the tube it attacks me with its powerful jaws.

In conclusion let us examine it with a little care. To the front of its chest, a little to one side, the sphex has affixed an egg. It is of a narrow, elongated, oval shape, white in colour, and three-quarters of an inch in length. The wasp always anchors it in the same position, transversely across the cricket's breast. There is a good reason for this fixity of instinct. The object in view is the security of the egg. It is a structure composed of the most delicate substance : the slightest pressure will destroy its vitality, and friction will tear it from its hold. Moreover, the cricket regains such strength that the egg will be exposed to many vicissitudes while its development is taking place. Hence it must be fixed to some special place where it will be free from external hurt. The most suitable spot is the cricket's breast ; there it is lodged in a deep recess, anchored to a surface which is free from movement and protected laterally by the bases of the limbs. There too it is sufficiently raised from the ground to escape friction when the cricket moves.

All the stages in the drama which I have here described, the laborious search, the frenzied excavation, the expulsion, the battle, the incarceration in the sand, all have been directed to the one purpose, the affixation of this tiny egg. With this act the duty of the hour is finished. The victim is stored, the egg is layed, the mouth of the tunnel is tightly closed. This episode in the life of the sphex is over ; she thinks no more of her buried treasure, but goes off to repeat the drama elsewhere.

(*To be continued*)

AN ACCOUNT OF SOME FRESH WATER CILIATES FROM LAHORE

BY

AMAR NATH GULATI, M.Sc.

(*With two plates*)

Before undertaking the description of the various forms a few words about the Ciliates in general will not be about of place.

The Ciliates are the most abundant and familiar of microscopic forms of life. They derive their popular name ciliate on account of the presence of small vibratile locomotary appendages called cilia. They are also called Infusoria, a term which was generally used to denote the various microscopic organisms which make their appearance in infusions exposed to air, but now the limits of the term have been narrowed down to denote Ciliata and Suctoria only.

They are mostly free-living aquatic forms, both marine and fresh water, but a large number of parasitic forms are also known to occur in the digestive tract of man, mammals and other vertebrata.

They are considered to be the highest of Protozoa, because in no other class namely Rhizopoda (amœba-like) Flagellata, or Sporozoa, does the cell-body attain so great a complication of parts, or so high a degree of structural differentiation. Unlike the above-named three classes, the Ciliata possess a well-developed mouth, sometimes a gullet also, an anus ; quite often organs of offence and defence, nuclei typically two in number : macronucleus and micronucleus, besides cilia the typical organs of locomotion which are again modified into simple cilia, cirri, membranellæ, and undulating membranes according as to the use they are put to, viz., cilia for swimming, cirri for creeping on the mud at the bottom of pools, and membranellæ and undulating membranes for assisting in prehension of food.

The present paper is based on the examination of samples of water from various localities in the near vicinity of Lahore. Several ponds, ditches, artificial small ponds (*chabacha*), small pools on the banks of the River Ravi, and the Chota Ravi, and the bed of the drying up canal-water course, were occasionally visited at different hours of the day for making such collections. Samples of running water were also often examined.

The observations were carried on during a period of ten months from June 1923 to April 1924, i. e., to include the physical conditions of the above-named localities, during the hottest, the rainy and the coldest months of the year. The bottom collections were always seen to be full of Protozoon life. The surface water, when covered over with whitish or green vegetable scum also showed a great number of these organisms.

The special features of the localities visited were that the ponds were covered over with a thick scum of duck-weed ; the ditches and artificial small ponds had putrifying dry leaves in them, and only those small pools on the banks of the river were selected for taking samples of water which had a thick whitish scum over the surface, for the reason that the thicker the scum, the larger was the number of organisms found in it.

The ciliate Protozoa were seen to live in association with flagellate Protozoa and Rotifers in the surface collections and the bottom collections showed the presence of several Nematode larvæ and other Oligocheata.

Ciliates of the genera. *Holophrya*, *Spathidium*, *Lacrymaria*, *Coleps*, *Didinium*, *Dileptus*, *Loxophyllum*, *Nassula*, *Chilodon*, *Glaucoma*, *Colpidium*, *Colpoda*, *Urocentrum*, *Cyclidium*, *Sigmostomum*, g.n., *Telotrochidium*, *Halteria*, *Urostyla*, *Pleurotricha* and *Gastrostyla* were found ; some of the species being new and others being described for the first time in India.

The only recent work on the fresh-water protozoan fauna of India is that by Professor B. L. Bhatia, and Professor E. N. Ghosh of Calcutta Medical College. I have referred to the former's papers, being unable to get hold of

Professor Ghosh's papers some of which have been published in comparatively little-known local journals, I have simply referred to the brief notes about his ppaers in the abstracts in the *Journal of the Royal Microscopical Society.* The only previous work worth mentioning is that of J. H. Carter, who studied these forms in Bombay towards the middle of the last century, and published a number of papers in the *Annals and Magazine of Natural History.* I could not refer to these papers, but I got the list of forms recorded by him from the table given in Professor Bhatia's papers. I have followed Schewiakoff's classification of these organisms as given by Hickson in Lankester's system. For specific diagnosis I have referred to Saville Kent's *Manual of the Infusoria* and Eyeferth's *Einfachste Lebensformen* and *Fresh-water Biology* by Ward and Whiple. Various other papers the loan of which I obtained from Professor B. L. Bhatia, and others that I was able to consult in from various journals, are arranged in alphabetical order in the reference list given at the end.

I wish to take this opportunity of expressing my indebtedness to Professor B. Bhatia for his valuable guidance.

Order—HOLOTRICHA.

Sub-order—GYMNOSTOMATA.

Family—*HOLOPHRYINA* Perty.

Genus—*Holophrya* Ehren.

Holophrya simplex Schewiakoff. (Plate I, fig. 1.)

Body 52 × 39 mic., oval, cylindrical, a little less than one and a half times as long as broad. Entirely ciliate, cilia small, and close set. Body full of vegetable matter, so details of internal structure could not be seen in the living specimens. Oral aperture at the anterior end, not projecting ; pharynx absent. Contractile vacuole single, subcentral. Macronucleus oval in shape, situated in the middle of the body ; micronucleus, a small round structure, lying near the periphery. Habitat : stagnant water covered over with thick green scum ; surface sample,

A few specimens of this species, as defined above were found in a temporary collection of water in a ditch on the road-side in front of the Biological Laboratory, Government College, Lahore, on the 25th January 1924, at about 9 a.m. It was only occasionally that specimens of this species were found in collections from this water. The arrangement of cilia in longitudinal striæ could not be made out on account of their being full of vegetable matter. Only one contractile vacuole was seen. No feeding vacuoles were seen, due probably also to the dark appearance of the body. There were no trichocysts. The shape of macronucleus described in this species is globular, but in the specimens obtained by me the shape is ovoidal. They correspond with the description given in Eyeferth in all other respects.

This species is being recorded for the first time in India.

Genus—*Spathidium* Dujard.

Spathidium spathula O. F. Müller, var. *moniliforme* B. L. Bhatia. (Plate I, fig. 2.)

Body 112 × 85 mic. ; flask-shaped, neck of the flask being extremely small ; flexible ; anterior end narrower than the middle of the body ; width increases posteriorly, the posterior end being broadly rounded. Mouth occupies almost completely the narrow anterior end. The margins of the oral portion are padded. The general surface of the body appears to be striate. The ciliation is uniform except that the cilia round the anterior end are slightly longer. The movements of the animal are slow. Contractile vacuole is poster-terminal. Macronucleus consists of a long chain of small beads. Length is one and a half times as long as the width. It differs from the description given by Professor B. L. Bhatia in the proportion of length to width, the width noted by him being only 20 mic. against 105 mic. of its length, while in the specimens obtained by me length is only 1½ times as long as broad. Only a few specimens were obtained so the measurements have not been considered as a specific character.

Habitat: Stagnant water from a drain in February.

Genus—*Lacrymaria* Ehren.

Lacrymaria striata sp. novo. (Plate I, fig. 3.)

Body 90 × 43 mic.; elongated; ellipsoidal in shape; anterior end shaped like the cork of a bottle, and surrounded by a ring of cilia; the body tapers to a narrow posterior end, which is completely occupied by the contractile vacuoles. Greatest width lies in front of the middle. Mouth at the anterior tip without any gullet. The whole of the body has a dark brown appearance except at the two ends, where it is transparent. Striations are both longitudinal and transverse. The anterior end is separated from the rest of the body by a constriction. Locomotion is not very swift. It has a calm, gliding movement, rotating round its axis. Length is twice as much as the breadth. Macronucleus oval, lies a little below the middle of the body. Micronucleus small, and round, lies about the middle of the body, a little in front of the macronucleus.

Habitat: From the stagnant water of a drain. The specimens encountered differ from all other known species of the genus as regards the general form of the body; of the longitudinal and transverse striations of the cuticle; and the contractile vacuole, which occupies the whole of the posterior end. The name *L. striata* is suggested. Specimens obtained were few.

Family—*COLEPINA* Ehren.

Genus—*Coleps* Nitzsch.

Coleps hirtus O. F. Muller. (Plate I, fig. 4.)

Body 52 × 24 mic., ovate, sub-cylindrical, more or less barrel-shaped; persistent in form; about twice as long as broad. Anterior margin denticulate; three spinous processes developed at the posterior extremity; cuticular surface usually longitudinally and transversely furrowed, and thus divided into quadrangular areas. Ciliated all round, cilia round the oral aperture are slightly larger than those on the general body surface. Anal apertures are situated at the anterior and posterior ends respectively. Macronucleus is spherical and central in position. Contractile vacuole is single, and is situated posteriorly. Brisk movement; rotates vigorously on its own axis, when it wants to throw out excreta. The colour of the animal is dark brown.

Habitat: Pond water among duckweed and algæ, more generally at the bottom. From a small pond near Data Ganj Bakhash.

Family—*CYCLODINA* Stein.

Genus—*Didinium* Stein.

Didinium nasutum Stein. (Plate I, fig. 5.)

Free-swimming animal-cules; body 102 × 40 mic., ovate, or sub-cylindrical, about one and a half times as long as broad, the anterior border produced into a snout-like process; it is a protrusible, tubular projection, at the distal extremity of which is the oral aperture. Cilia restricted to two girdles, subservient merely to the purpose of locomotion. Anterior girdle of cilia is developed close to the base of the proboscis. The posterior girdle is at a distance of one-third of the total length of the animal from the posterior extremity. Micronucleus: band-like, curved into a horse-shoe, lying close to the anterior girdle of cilia. Contractile vacuole postero—terminal. Anal aperture at the posterior extremity close to the position of the contractile vacuole. Greenish or white in colour.

Habitat: Pond water brought along with frogs from near Chauburji.

Didinium balbianii Butschli. (Plate I, fig. 6.)

Specimens of this rare form were met with in the same water from which the other species *D. nasutum* was found. This is characterized by the presence of a single girdle of cilia situated near the base of the proboscis.

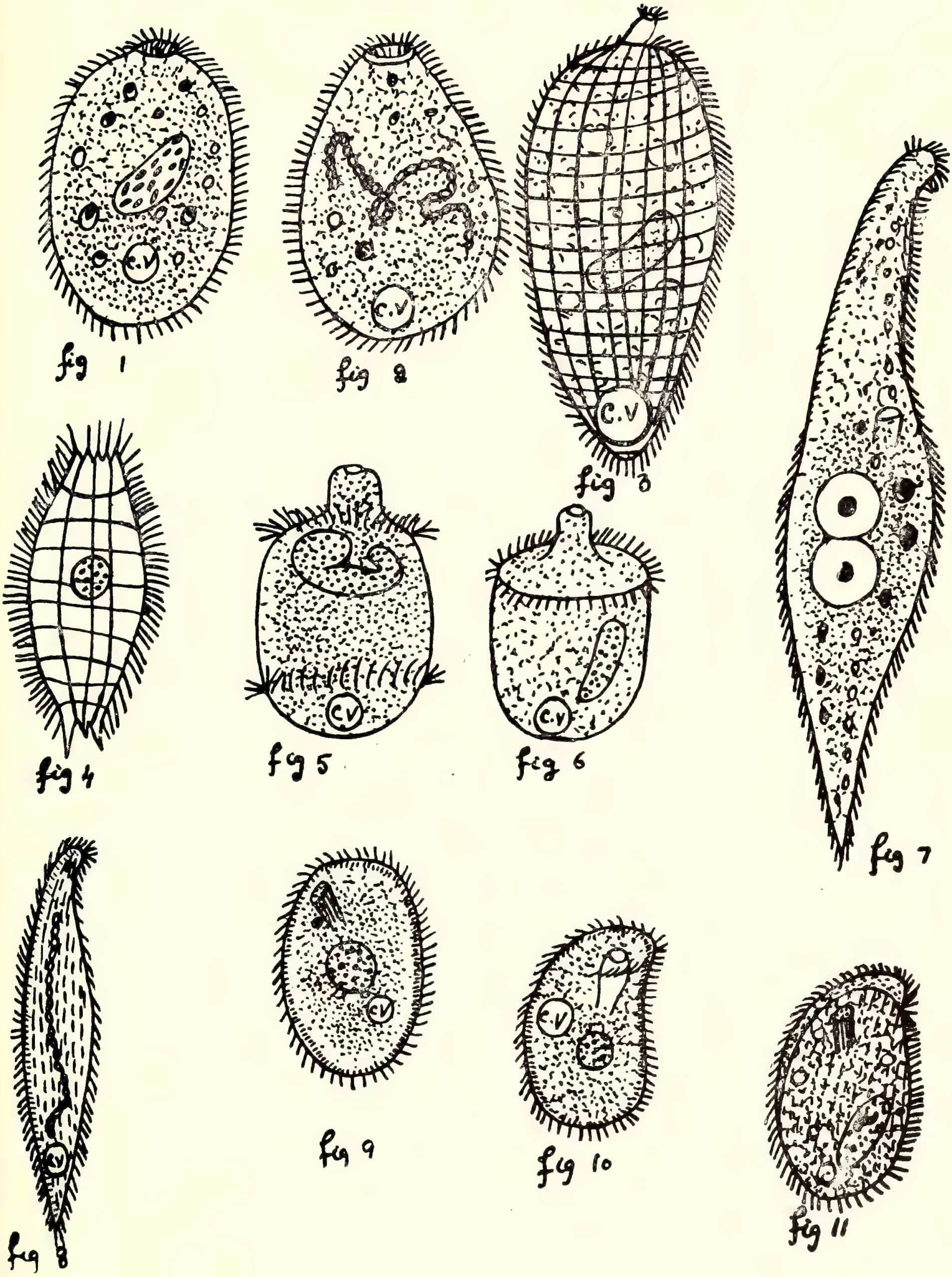
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fig 10
fig 11

Fresh-Water Ciliates from Lahore

Macronucleus is seen to lie along the long axis of the body. It is band-like and only slightly curved at the two ends. The contractile vacuole is posteroterminal. Length 50 mic., width 35 mic.

It is conceivable that forms described as *D. balbianii* are only individuals resulting from a transverse division of individuals of *D. nasutum* which have not had time to develop a posterior ciliary girdle. But further observations are regarded essential to establish the specific identify of the two.

Family—*TRACHELINA* Stein.

Genus—*Dileptus* (Dujardin) emend. Wrzeaniowski.

Dileptus gigas (Clap. and Lachm.) Wrzeaniowski.

(Syn. *Vibris anser* O.F. Muller ; *Amphileptus gigas* Clap. and Lachm.).

Plate I, Fig. 7.

Body elongate, lanceolate, pointed posteriorly, the anterior trunk-like appendage equals one half of the total length of the entire body. The body, and the neck showed movements characteristic of the species, locomotion consisting chiefly of swift progression in a straight forward direction, accompanied by rotation of the body on its long axis, the proboscis meanwhile being thrust around in a tentative manner in search of prey. The specimens obtained by me are on an average 150 mic. in length. The cilia covering the body are very fine and close-set, and the neck shows a narrow groove along which the strong adoral cilia are situated. The body does not show any longitudinal striations, but the endoplasm is finely granular. The proboscis is transparent, while the rest of the body appears darker on account of the greater density of endoplasm in that region. Macronucleus consists of two rounded bodies placed side by side. Micronucleus is present and lies near the macronucleus. Pharynx cylindrical, at the top of which the mouth is situated, lies near the base of the proboscis.

Habitat : Found in small pools on the bed of the drying up water-course running through Gol Bagh.

Family—*AMPHILEPTINA* Butschli.

Genus—*Loxophyllum* Dujard.

Loxophyllum meleagris Ehren. (Plate I, fig. 8.)

Free swimming ; flattened ; flexible ; finely and entirely ciliate, lanceolate, the anterior extremity bluntly pointed, and curved, the posterior end is somewhat rounded. Length is to breadth as 5 is to 1. Average length 70 mic., average breadth 14 mic. Locomotion, quiet and gliding. Trichocysts present along one border. Mouth ventrally situated. Contractile vacuole lies near the posterior extremity. Cilia arranged in longitudinal striations on the general body surface. Macronucleus long, cord-like, twisted round itself like a rope.

Habitat : Bottom samples of stagnant water. I obtained only two specimens in the month of October 1923.

This species is being recorded for the first time from India.

Family—*NASSULINA* Butschli.

Genus—*Nassula* Ehren.

Nassula rubens Clap. and Lachm. (Plate I, fig. 9.)

Body 90 × 50 mic., ovate, cylindrical ; flexible ; not polymorphic, equally rounded at the two ends. Evenly ciliate. Brick red, or rose colour. Pharyngeal armature consisting of distinct rod-like teeth ; the tube formed by them is slightly wider anteriorly. Trichocysts are abundant all round. Contractile vacuole is single, subcentral. Macronucleus consists of chromatinic masses within the nuclear membrane. Micronucleus : small, rounded lying near pharyngeal tube. These specimens differ from those described by Kent as regards the ratio between length and width only.

Habitat : Found in pools on the bed of the drying up water-course running through Gol Bagh.

This species is being recorded for the first time in India.

Nassula ambigua Stein. (Plate I, fig. 10.)

Body 80 × 50 mic., oval; anteriorly deflected a little along an oblique row of cilia; equally rounded at both extremities about one and a half times as long as broad. Evenly ciliate. Pharynx consists of a horny tube dilated anteriorly, and has got no rod apparatus. Contractile vacuole single, spherical, central in position. Macronucleus rounded, micronucleus could not be seen. Beautifully coloured with red and green dots.

Habitat: Pools on the bank of the water-course in the Gol Bagh.

This species is being recorded for the first time from India.

Family—*CHLAMYDODONTA* Stein.

Genus—*Chilodon* Ehren.

Chilodon cucullus Muller. O.F. (Plate I, fig. 11.)

Body 45 × 28 mic., flattened, persistent in shape, sub-ovate, produced anteriorly into a lamellar, flexible, lip-like prominence, sharply pointed and curved towards the left. Locomotion gliding and undulating. The lip-like projection is obliquely striate; but the general body surface bears cilia along fine longitudinal striations; cilia are close-set and fine. Mouth, in the anterior one-third of the body, is succeeded by a tubular pharynx containing delicate rods. Numerous small vacuoles are distributed in all parts of the body. Macronucleus oval, with one or more big chromatin masses, micronucleus lies close to the macronucleus; contractile vacuoles more than one, and irregularly distributed.

Habitat: Found in large numbers in the month of February 1924, from small pools on the bank of the Chota Ravi.

Sub-order—HYMENOSTOMATA Delage.

Family—*CHILIFERA* Butschli.

Genus—*Glaucoma* Ehren.

Glaucoma scintillans Ehren. (Plate II, fig. 12.)

Oval in form; persistent in shape, with a convex dorsal and a flattened ventral surface. Oral aperture is situated ventrally towards the anterior extremity, and is associated with a minute vibrating flap-like membrane. The contractile vacuole is posteriorly located. Cilia are evenly distributed all over the body, being disposed in longitudinal striæ on the general body surface.

Macronucleus oval, shows a granular structure and lies in the centre of the body. Micronucleus small, rounded, lies on one side of the macronucleus. There are several food vacuoles in the body cavity distributed round the macronucleus in an irregular manner. Length is one and a half times as long as the width. Colour is greenish white.

Habitat: Found from the ditch outside the college laboratory in January 1924.

This species is being recorded for the first time from India.

Genus—*Colpidium* Stein.

Colpidium striatum Stokes. (Plate II, fig. 13.)

Body 35 × 17 mic., egg-shaped, anterior end thinner than the posterior; persistent in shape. Mouth near the anterior end with two undulating membranes, one of which is continued down into the gullet. Cilia evenly distributed, arranged in longitudinal rows on the body surface. Length is about twice as long as the breadth. Contractile vacuole single, lies near the posterior end. Macronucleus is a rounded structure with a central big chromatin mass. Micronucleus small, situated a little in front of the centrally located macronucleus.

Habitat: Infusion of dry leaves and hay.

This species is being recorded for the first time from India.

Colpidium compyla Stokes. (Plate II, fig. 14.)

Body ellipsoidal, more elongated than in *C. striatum*, persistent in shape, sharply rounded at the two ends, length is four times as long as the breadth. Cilia are evenly distributed all over the body and are arranged in longitudinal rows. Mouth as in other members of the genus. Contractile vacuole is single posteroterminal. Macronucleus rounded, lying in the anterior half, near the centre of the body. Micronucleus lies near the contractile vacuole near the posterior extremity. Stained preparation show the micronucleus distinctly. Length 70 mic. width 17 mic.

Habitat : Hay infusion.

This species is being recorded for the first time from India.

Colpidium colpoda Stein. (Plate II, fig. 15.)

Body egg-shaped, anterior end seems to be twisted round the body, mouth followed by a short gullet supporting an undulating membrane which projects out in a tongue-like manner ; cilia evenly distributed all over the body, oblique rows of cilia on the general surface. Contractile vacuole is single and posteroterminal. Macronucleus centrally placed shows two big chromatin masses and small particles of chromatin besides. The body is filled up with numerous food vacuoles. The cysts are rounded and burst open to set free at least 4 individuals, when the conditions are favourable. Length twice as much as the breadth, i.e., 70 mic. and 35 mic. respectively.

Habitat : Infusion of dry leaves.

Genus—*Colpoda* Muller.

Colpoda cucullus Ehren. (Plate II, fig. 16.)

Body 46 × 28 mic., kidney-shaped ; not persistent, protoplasm seems to flow into different forms ; the anterior end is curved. Length is to breadth as three is to two. Ciliation even, in oblique longitudinal rows on the general body surface. Contractile vacuole single, sub-central. Macro and micro-nuclei both present, situated posteriorly. Locomotion swift.

Habitat : Infusion of hay and dry leaves.

It is very similar to *Colpidium colpoda*, except in its kidney-like form which exhibits changeability.

This species is being recorded for the first time from India.

Family—*UROCENTRINA* Clap and Lach.

Genus—*Urocentrum* Nitzsch.

Urocentrum turbo. Ehren. (Plate II, fig. 17.)

Body 45 × 32 mic., almost cylindrical ; rounded anteriorly and posteriorly. Locomotion quick ; darting off like an arrow, with simultaneous rotation on long axis, and showing jerks among changes of direction. Cilia reduced to two bands, one anteriorly and the other posteriorly. The anterior band consists of many rows of cilia. There is a bunch of long cirri at the posterior end. Mouth on the ventral side with a flap-like undulating membrane, leading into a gullet which opens near the contractile vacuole to the out by the side of anus. The contractile vacuole is spherical, and is seem to be formed by the coalescence of four long canals. Macronucleus : horse-shoe shaped, shows a granular structure ; micronucleus was not seen.

Habitat : Found in a pond near Data Ganj Bakhash and in a small pond in Gol Bagh in October and February respectively.

This genus and species is being recorded for the first time from India.

Genus—*Telotrochidium* Kent.

Telotrochidium natthaii sp. nov. (Plate II, fig. 18.)

Animalcules entirely free swimming, ovate, companulate or sub-quadrate, with a round convex anterior margin, and a knob-like projection is protruded asymmetrically on one side of the posterior margin. This knob is retractile and the retracted specimens appear cup-like. Cilia are restricted to two girdles only, each consisting of a single row of cilia all round. The posterior girdle is hidden from view on retraction. Mouth lies about the middle of the body on the ventral side and leads into a ciliated gullet which opens out by the anus situated close to the posterior projection. There are one or some times two contractile vacuoles which lie in the neighbourhood of the mouth. Macronucleus is a long ribbon with numerous karyosome-like bodies. The two extremities are curved up to give it a horse-shoe appearance.

Micronucleus oval or rounded, usually found lying at one of the angles of the macronucleus. The usual ratio between the length and the breadth is as 4 : 3. Fission is always longitudinal, animalcules increase in breadth and ratio of length to breadth becomes 5 : 7. A constriction appears in the hinder region by the formation of an other knob-like projection on the other side. The constriction deepens and the two animals appear as if fused together. The macronucleus is now a straightened ribbon stretching at its full length along the width of the animal. The micronucleus divides but the process of division has not been determined, but probably it is by mitosis as the two halves have been seen to be united by a thin cord. These animalcules go on dividing by binary fission till the size is reduced to one-fourth of the parent form. These appear more or less like the gametes of Vorticella. Some of these are rounded and others become elongated, the latter are smaller in size. They do not seem to possess any mouth or anus probably because the process of division becomes rapid and the formation of these organs cannot keep pace with the division rate. The nucleus in these forms has been seen to be oval in form. No micronucleus was seen. Rounded and elongated forms were seen to come together and fuse completely, till the elongated small individual had flown completely into the rounded individuals and was one with it. Nuclear changes of this process could not be observed, because the above-noted stages were encountered in a hanging drop preparation. The individual thus formed had got encysted on the second day. Normal individuals were also seen to encyst in such preparations after two days at the most. The cysts are spherical, with a thick outer coat. There are two or more vacuoles inside each encysted individual. The whole of the protoplasm is seen to rotate in freshly encysted individuals. The structural appearance is granular with a darker granular zone along one margin showing the position of the nucleus. Length 145 mic., breadth 108 mic., greatest breadth in the anterior half in the region of the anterior girdle of cilia.

Habitat : Found in a ditch where dried leaves were rotting.

Specimens were found in great abundance and they were later on grown on Schewiakoff's culture fluid in which they flourished and multiplied in large numbers. At first sight they present a resemblance to detached vorticellæ, but on more intimate acquaintance, they showed resemblance to *Urocentrum* in many respects and so they have been referred to that family group. The organism however differs from the genus *Urocentrum*, in the mode of locomotion ; the character of the ciliary girdles, which are only one row thick as also in the anterior girdle of *Urocentrum*, but the posterior girdle runs obliquely here almost along the posterior border, while it runs transversely in *Urocentrum* about one-third of its length from its posterior end ; mouth is without a flap-like undulating membrane, only one or at the most two or three caudal bristles replace the bunch of caudal cirri found in *Urocentrum*, and also in its mode of binary fission. It shows a good deal of resemblance to a genus *Telotrochidium* discovered by Kent as regards its shape, mode of locomotion, presence of two ciliary girdles only one row thick, and in the longitudinal mode of fission. It however differs from *Telotrochidium* in the following respects :—

(1) The posterior girdle of cilia runs obliquely almost along the posterior border, which runs transversely across the body in *Telotrochidium*, at about one-third of the length of the body from the posterior end.

(2) There is no thick annular border associated with the anterior girdle of cilia, as described in the type species of the genus *Telotrochidium*.

(3) The posterior end is not described as retractile in *Telotrochidium*, while it is so in these animalcules. The organism retracts this posterior end with a jerk recalling the contraction of a vorticellid.

Taking into consideration the above-mentioned points, the specific name *matthaii* is suggested as a small tribute of gratitude to my worthy teacher, Professor George Matthai.

Family—*PLEURONEMINA* Butschli.

Genus—*Cyclidium* Clap. and Lach.

Cyclidium glaucoma Ehren. (Plate II, fig. 19.)

Body 25 × 14 mic., egg-shaped ; broader at the posterior extremity with a long bristle posteriorly. Locomotion very swift, shooting like an arrow,

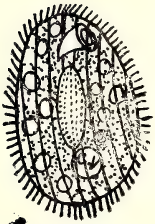


fig 12

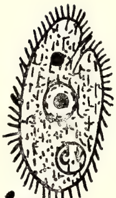
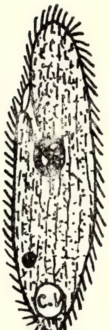


fig 13



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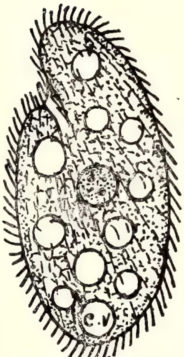

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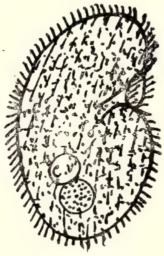

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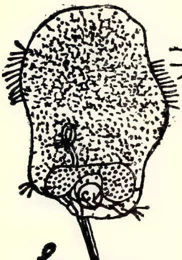

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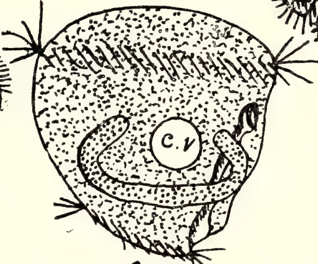

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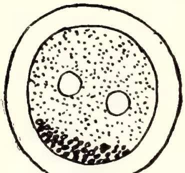
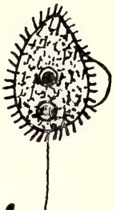


fig 18a



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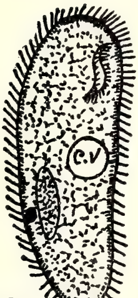

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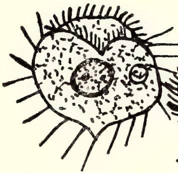


fig 21

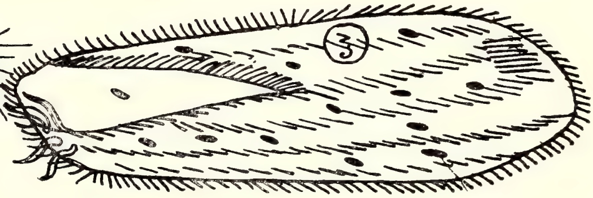
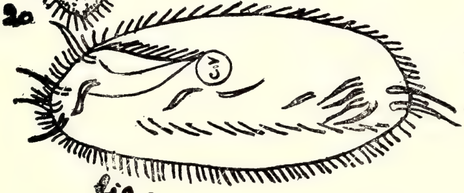


fig 22



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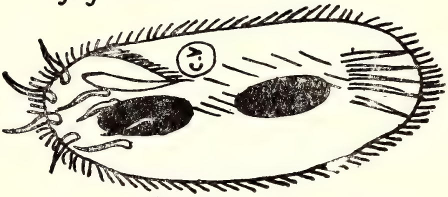

fig 24

FRESH-WATER CILIATES FROM LAHORE

alternating with standing still. Very quick, changing its directions, often in a jerky manner. The cuticular surface is longitudinally striate, the peristome does not extend much further behind the middle of the body, and the undulating membrane is large, hood-like and extensile. The macronucleus is central and spherical with a karyosome in the centre. The contractile vacuole is situated near the posterior end.

Habitat: Stagnant water in pools on the bank of the Chota Ravi in November.

Family—*CHILIFERA* Butschli.

Genus—*Sigmostomum* Gen. Nov.

Sigmostomum indicum sp. nov. (Plate II, fig. 20.)

Body 145 × 52 mic., oval, anterior end a little broader than the posterior end. Cylindrical, persistent in shape. Eugulfs large filamentous algæ, as big as its own length or even larger. In the latter case the wall of the body gets projected out at a point where the filament pushes it. Often one end of the algal filament is seen projecting out of the mouth opening or the anal opening. Cilia are evenly distributed all over the body. Mouth is situated on the ventral surface in the anterior half of the body, and there is no peristomial field leading to it. There is no gullet. Mouth is an S shaped slit lined by undulating membranes on both the lips. Locomotion swift, restless, rotating round its axis. Contractile vacuole single, spherical, situated near the periphery at about equal distance from either end of the body. Trichocysts studded all round below the outer layers of the ectoplasm. They are shot out on application of various fixatives or even very weak grades of alcohol. Macronucleus is oval in shape, lies in the posterior half of the body and presents a granular structure; these granules seen to be united by a reticulate net-work. Micronucleus small, lying by the side of the macronucleus, is also oval in shape. Length is about three times the breadth.

Habitat: Pond water, surface collections covered over with filamentous algæ. I found it from small temporary collections of water near the fountain pond opposite the Town Hall.

The organism is placed in the family *Chilifera* by virtue of its possessing the following characters :—

1. Absence of peristomial field.
2. Mouth in the anterior half.
3. Gullet scarcely developed.
4. Undulating membranelless at the edge of the mouth.

The organism differs from any of the genera described in this family in the combination of the following characters :—

Mouth not situated at the anterior end, curved in the form of an S and provided with undulating membranelless along with lips, gullet completely absent, posterior end of the body without a caudal cilium. The contractile vacuole in the middle of the body, macronucleus oval, trichocysts well-developed, persistent shape of the body, and the locomotion being always accompanied with rotation on its own axis.

It comes nearest to the genus Glaucoma in the combination of the above characters but differs from it by the fact that there is a membranelle all round the margin of the mouth instead of a continued undulating membrane. The macronucleus is oval and the contractile vacuole is situated in the middle of the body.

The name *Sigmostomum* is suggested for this genus and the species is proposed to be called *S. indicum*.

Order—HETEROTRICHA Stein.

Family—*HALTERINA* Clap and Lach.

Genus—*Halteria* Dujard.

Halteria grandinella Muller. (Plate II, fig. 21.)

Body 28 × 28 mic., free swimming animalcules. Form somewhat spherical, usually terminating posteriorly in a somewhat narrower obtusely rounded point; and a small triangular depression at the anterior end associated with a spiral of fine cilia; a zone of long hair-like setæ or springing hairs are developed round the central region of the body, the flexure of which enables the animalcules to progress through water, by a series of leaping movements. Contractile vacuole in the anterior half, spherical in form. Macronucleus : oval or kidney shaped, with one or two karyosome-like bodies in it.

Habitat : Fresh-water from little pools on the bank of the canal water course in Gol Bagh.

Order—HYPOTRICHA Stein.

Family—*OXYTRICHA* Stein.

Genus—*Urostyla* Ehren.

Urostyla weissii Stein. (Plate II, fig. 22.)

Body 130 × 42 mic., elongated elliptical, flexible to a high degree. Three to five frontal cirri and 7–8 anal cilia. Colour yellowish. Anterior is narrower than the posterior ; greatest width in the posterior half of the body. Peristome field forming an acute angled triangle extending to a little beyond the anterior one-third of the body. There are five median rows of short ventral setæ. Marginal cilia form a continuous row. Contractile vacuole single sub-central. Macronucleus broken up into many small oval bodies ; micronucleus not distinguishable.

Habitat : Surface collections of water among algal filament.

This species is being recorded for the first time from India.

Family—*PLEUROTRICHINA* Butschli.

Genus—*Pleurotricha* Stein.

Pleurotricha grandis Stein. (Plate II, fig. 23.)

Free swimming. Persistent in shape ; elongate elliptical, length twice as much as the width. Peristome not extending up to the middle. Six frontal cirri well-developed ; three or four scattered ventral setæ ; anal setæ disposed in two groups, each 5–6 in number, two of them are projecting posteriorly much beyond the margin. One or more rows of cilia supplementing the modified cirri on the ventral side. Contractile vacuole near the peristomial angle.

Habitat : In infusion of dry leaves.

Genus—*Gastrostyla* Engelmann.

Gastrostyla setifera Engelmann.

Plate II, fig. 24.

Body 90 × 30 mic., elongated, widest centrally, about two and a half times as long as broad. Peristome field hardly extending up to the middle of the body; its reflected border bearing a band-like undulating membrane. Eight frontal styles disposed of in a definite arrangement supplemented by two short rows of ventral setæ ; five anal styles besides. Contractile vacuole single, spherical. Macronucleus consists of two pear shaped bodies. Micronucleus was not seen.

Habitat : From a small pond near Data Ganj Bakhash in October.

This genus is being recorded for the first time from India.

GENERAL SUMMARY

To summarize, I have, in all come across 20 genera in 29 species of fresh water ciliates as represented in the table below. Out of these 17 genera have already been recorded by the previous workers. Out of the remaining 5 genera, 4 are being recorded for the first time from India and one I propose to call new to science. I have, however, in the present paper restricted to the description of those species only where I had something to add to the already-known facts about them or that they were either new species to science or were described for the first time in India. The following is the table of the Indian species of ciliates :—

Species	*Other authors*	*By the author*
Holophrya lateralis S. K.	+	—
,, *indica* Bhatia	+	—
,, *bengalensis* Ghosh	+	—
,, *annandalei* Ghosh	+	—
,, *simplex* Schew	—	+

Species	*Other authors*	*By the author*
Urotricha globosa Schew.	+	−
Enchelys arcuata Clap. and Lachm.	+	−
Spathidium spathula var *moniliforme bhatia*	+	+
Prorodon teres Ehren.	+	−
,, *eudentatus* Clap. and Lachm.	+	−
Lacrymaria vermicularis Ehren.	+	−
,, *striata* sp. nov.	−	+
Coleps hirtus Muller	+	+
,, *kenti* Bhatia	+	−
,, *uncinatus* Clap. and Lachm.	+	−
Didinium nasutum Stein.	+	+
,, *balbiani* Butschli.	−	+
Mesodinium pulex Clap. and Lachm.	+	−
Loxophyllum fasciola Ehren.	+	−
,, ,, sub. sp. *punjabensis* Bhatia	+	−
,, *meleagris* Ehren.	−	+
Loxodes rostrum Ehren.	+	−
Nassula sp.	+	−
,, *stromphii* Ehren.	+	−
,, *rubens* Clap and Lachm.	−	+
,, *ambigua* Stein	−	+
Chilodon cucullus Muller	−	+
Glaucoma pyriformis (Stein) ?	+	−
,, *scirilillans* Ehren.	−	+
Trichoda pura Ehren.	+	−
Frontonia leucas Ehren.	+	−
Ophryoglena sp. (*Otostoma carteri* S. K.)	+	−
Colpidium striatum Stokes	−	+
,, *comyla* Stokes	−	+
,, *colpoda* Stein	−	+
Colpoda cucullus Ehren.	−	+
Paramoecium aurelia Muller	+	+
,, *caudatum* Ehren.	+	+
,, *bursaria* Ehren.	+	+
Urocentrum turbo Ehren.	−	+
Telotrochidium matthaii sp. nov.	−	+
Cyclidium glaucoma Ehren.	+	+
Sigmostomum indicum g. n. sp. nov.	−	+
Pleurotricha grandis Stein	+	+
Urostyla weissi Stein	+	+
Gastrostyla setifera Engelmann	−	+
Euplotes charon Muller	+	+
Aspidisca costata Dujard	+	−
,, *lynceus* Ehren.	+	−
Scyphidia formentelii S. A.	+	−
Vorticella microstoma Ehren.	+	+
,, *patellina* Muller	+	−
,, *convallaria* L	+	−
,, *campanula* Ehren.	−	+
Vorticella citrina Ehren.	+	−
Carchesium epistylidis Clap. and Lachm.	+	−
,, *polypinum* Ehren.	+	−
Epistylis galea Ehren.	+	−
,, *plicatilis* Ehren.	+	−
,, *articulata* From	+	−
Cothurnia sp. (= *Pyxicola carteri* S. K).	+	−
Vaginicola sp.	+	−
Sphærophrya sp.	+	−
,, *pusilla* Clap. and Lachm.	+	−
Podophrya fixa Ehren.	+	−
,, *libera* Perty	−	+
Tokophrya quadripartita Clap. and Lachm.	+	−
Acineta tuberosa Ehren.	+	−

The freshwater Protozoa are no doubt cosmopolitan in their distribution and the conclusions drawn by Schewiakoff after an elaborate study of their distribution, and as already confirmed by Professor Bhatia can be confirmed by me also in so far as they apply to the group *Ciliata*. Out of the 32 species studied by me as many as 29 are such as are already described from other countries. Only three of them I am proposing to call new species. Two of these new species I have studied in detail as much as the circumstances allowed. I grew one of these species, namely *Telotrochidium matthai* in Schewiakoff's culture fluid with a little modification. However my observation could not cover the whole life-history of this species.

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References for best figures and description

As to the best references for figures and descriptions of the species, the author has found numbers 18 and 28 of the reference list at the end of the paper to be the best. Another book on fresh water Biology by Ward and Whiple, is also recommended.

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THE IDENTIFICATION OF INDIAN BUTTERFLIES

By Colonel W. H. Evans, D.S.O., F.Z.S., F.E.S.

(*Continued from page 639 of this Volume.*)

Part VIII

(*With 1 Plate*)

H.50. Surendra.—The Acacia Blues. (Plate 29.)

1a (4). Above purple with broad dark borders. Below dark brown with very narrow black markings, some of which may be outwardly silver edged; unf a spot middle and end cell, 2 costal spots, a highly irregular discal line and submarginal spots. Unh basal and discal irregular line and submarginal dots; lobe black and a black spot in 2 with obscure green metallic scales; ground colour darkened mid termen F and about discal line H.

1b (3). ♂ tailed at v2; ♀ at vs 2 and 3.

1 (2). H highly excavated between 1 and 2, anal lobe large. ♂ upf dark purple blue; ♀ brown, paler brown on disc.

α. Small. ♀ pale discal area usually sharp defined. ♂ blue on H.

quercetorum discalis, *M.* (30–34). The Common Acacia Blue. Ceylon. C.

β. Small. ♀ pale discal area F diffuse. ♂ blue colour more restricted and absent on H.

quercetorum biplagiata, *But.* S. India. C.

γ. Larger, ♀ as last. ♂ with blue on H. Specimens from Assam, N. Burma and the Andamans are larger than from elsewhere.

**quercetorum quercetorum*. *M.* (30–40). Dun—Burma. Andamans. C.

2 (1). H straight between vs. 1 and 2, lobe small. ♂ above dark purple blue, borders half as wide as in last. ♀ dull lilac blue, shading basally to dull metallic blue; variable, may be all dull metallic blue. Tails very short and narrow.

amisena, *Hew.* (32–40). The Burmese Acacia Blue Tavoy—S. Burma. R.

3 (1b). ♂ ♀ Tailless, only a tooth at v2. ♂ above dark purple blue, borders as last. ♀ dark brown, bases broadly paler.

florimel, *Doh.* (36). The Tailless Acacia Blue. Tavoy—S. Burma. R.

4 (1a). Below pale ochreous brown, glossed vinous, no cell or costal spot unf. Unf a waved silvery discal line; unh an irregular silver line near base, another through end cell and a third post discal; tornal markings small. Single tail at v2.

α. ♂ above deep shining purple, border 2mm to 5 at apex. ♀ pale purple blue, more restricted than in ♂.

todara todara, *M.* (34–38). The Silver streaked Acacia Blue. S. India. R.

β. ♂ as last. ♀ rather pale purple, not purple blue.

* *todara distorta*, *DeN.* Sikkim—Shan States. R.

γ, ♀ pale metallic blue, border 1mm to 4 at apex, a black spot end cell. Below darker and markings rather differently arranged, being a cross between No. 4 and No. 1; unf discal line obliquely bent in from v3 to costa; unh central line as in No. 1 and post-discal line obscure as in No. 1.

todara karennia, *Evans.* (32). Karen-Dawnas. VR.

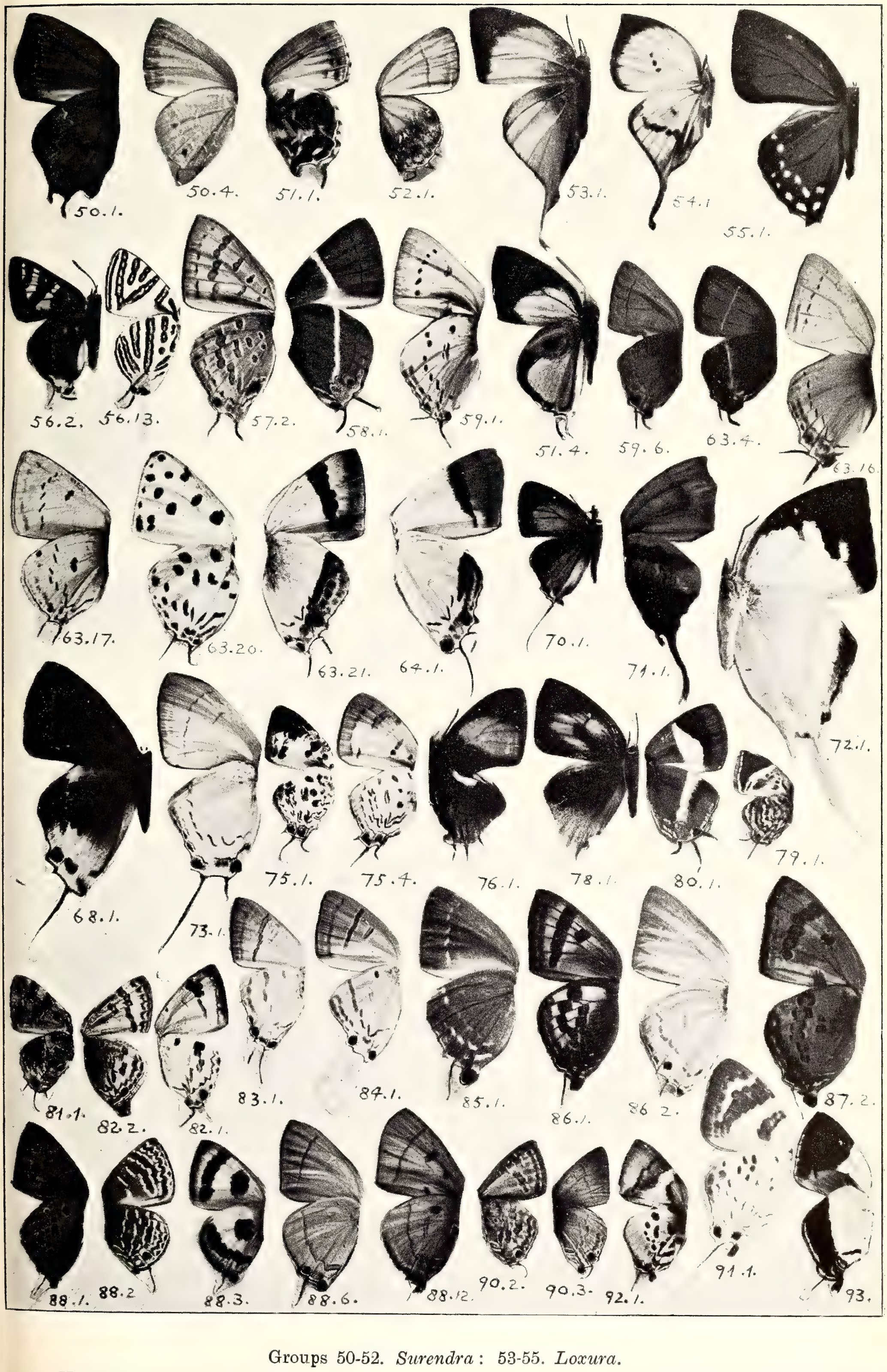
H.51. Mota—The Saffron. (Plate 29.)

♂ above dark purple with a broad dark apex and narrow border; ♀ purple blue, paler, border F broad and all H dark brown. Below saffron; unf a dark bar end cell, a post discal and submarginal line, area between clouded; unh almost entirely covered with large dark brown irregular markings, white edged and coalesced, lobe ochreous and termen irrorated white scales.

* *massyla*, *Hew.* (42–35). The Saffron. Bhutan—Burma. R.

H.52. Semanga—The Rededge. (Plate 29.)

Above shining violet blue, border F 2mm. to 4 at apex; H costa broadly dark, tornus orange from dorsum to 3, crowned black. Below pale ochreous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63.16.
63.17.
63.20.
63.21.
64.1.
70.1.
71.1.
72.1.
68.1.
73.1.
75.1.
75.4.
76.1.
78.1.
80.1.
79.1.
81.1.
82.2.
82.1.
83.1.
84.1.
85.1.
86.1.
86.2.
87.2.
88.1.
88.2
88.3.
88.6.
88.12.
90.2.
90.3.
92.1.
91.1.
93.

Groups 50-52. *Surendra*: 53-55. *Loxura*.
H. **Lycaenidae.** 56-57. *Spindasis*: 58-63. *Tajuria*: 64-70. *Jacoona*: 71-78. *Marmessus*:
79-80. *Horaga*: 81. *Catapoecilma*: 82-84. *Hypolycaena*: 86-93. *Artipe*.

H.52. Semanga—(*contd.*)

brown ; F a discal and submarginal ferruginous line ; H basal area unmarked, outer half ferruginous red, inwardly with series of oblique metallic blue streaks, centrally with large obscure black spots, most prominent in 2 and 6 irrorated white scales along termen, especially near tornus.

* *superba, Druce.* (32). The Rededge. Mergui. VR.

H.53. Loxura.—The Yamfly. (Plate 29.)

Above orange, broad black apex and termen F, narrow border H, bases more or less suffused dark brown. Below ochreous with more or less obscure pale brown basal spots, discal and submarginal bands.

a. Upf inner edge of black apex evenly arched ; bases slightly darker, suffused.

atymnus arcuata, M. (36–40). The Yamfly. Ceylon. NR.

β. From as next to a dark orange with broader black apex, extending to base along costa, inner edge evenly arched, bases broadly suffused, vs 6 and 7 H prominently black. Apex F more rounded.

atymnus surya, M. S. India. NR.

γ. Dark apex narrower, inner edge obtusely angled, DSF not basally suffused, vs 6 and 7 H not black. Paler than last.

* *atymnus atymnus, Cr.* Central India—Mussooria-Burma. C.

δ. Larger, brighter orange, apex broader, evenly arched and penetrated by yellow veins, base prominently suffused dark brown and in H practically the whole wing suffused.

atymnus prabha, M. (40–42). Andamans. Nicobars. NR.

H.54. Yasoda.—The Branded Yamfly. (Plate 29.)

Above orange with a black apex and border F ; upf with a black bar end cell and 3 discal spots ; uph a bar end cell and an oblique discal band ; the black markings may be reduced or absent. Below ochreous to ochreous brown with more or less obscure black rings, arranged irregularly towards base and as a discal band, which turns white towards dorsum H ; tornal markings obsolete ;

**tripunctata, Hew.* (42–40). The Branded Yamfly. Sikkim-Burma. R.

H.55. Drina.—The Yams. (Plate 29.)

1 (2). ♂♀ above dark brown, outwardly darker ; H discal row white spots followed by a submarginal row, larger in ♀. Below silky white, narrow discal and submarginal brown bands, tornal markings H obscure.

**donina, Hew.* (45–48). The Brown Yam. Lushai Hills—Burma. NR.

2 (1). ♂ upf except for base and broad termen, shining purple blue and the veins on the blue area pale yellow ; ♀ all dark brown ; uph dark brown with 2 large tornal white spots and a broad white sub-tornal band. Below white, apex and margin F broad dark chocolate brown, the inner third of the dark area being darker ; unh upper half of termen dark brown and a broad sub-tornal dark band.

maneia, Hew. (42–46). The Blue Yam. Mergui. R.

H.56. Spindasis—The Silverlines. (Plate 29.)

Below with silver centred broad dark bars and spots on a pale ground. Above dark brown, more or less shot blue, or fulvous ; tornus H usually broadly orange.

1a (2a). Unf sub-apical markings form a Y, consisting of a bar mid 4–5 placed centrally below 2 costal spots. Above mostly tawny, no blue ; tornus uph and unh not orange.

1 A (1 B). Above bases clear yellow. Upf pale apical spot in 6 only and never white. Dorsum F excavate posteriorly. Unf Submarginal band inwardly edged by crescentic lines.

epargyros, Evers. (30–34). The yellow Silverline. Baluchistan, R.

1 B (1 A). Above bases grey. Upf pale apical spot in 6 may extend into 5 and 4 and is white. Unf submarginal band inwardly edged straight lines. Dorsum F evenly convex.

a. Unh lowest of the 3 sub-basal spots rounded or elongate. Above bright tawny, base only suffused brown scales, black bands prominent in ♂, may be obsolete in ♀ ; on F marginal and submarginal black bands well separated.

H. 56. Spindasis—(*contd.*)

acamas hypargyros, But. (30–36). The Tawny Silverline. Cutch. Sind, Baluchistan. Punjab. R.

β. Below as last. Above much darker, suffused brown scales; in ♂ leaving only some tawny colour round the black spots F and very little on H : ♀ more tawny : marginal and submarginal lines widened and often confluent, forming a single very broad dusky band.

acamas chitralensis, Riley (34–38). Chitral. NR.

2a (1a). Unf sub-apical markings consist of an inner short and an outer long bar, each made up of 2 conjoined spots; these bars may be parallel or may form a V.

2b (14). Unh sub-basal band ends on v1 and is never continued along it.

2c (10a). Unf with a basal streak along the costa from the central cell bar; this streak in the DSF may only be indicated by a few silver scales and be hard to see. The basal markings in the cell unf consist of a streak from the base under the scv and a spot beyond, the two being conjoined or separate; in the DSF the streak may be absent.

2d (4a). Unh sub-basal band entirely confluent from the costa to v1. Below yellow with conspicuous red bands, more or less black edged.

2 (3). ♂ above not or only very faintly blue shot, ♀ without conspicuous plumbeous scales.

α. Upf orange areas restricted. Unh central band more separated from the postdiscal band, rendering discal yellow area wider.

vulcanus fusca, M. (26–34). The Common Silverline. Ceylon. C.

β. Upf orange areas wider. Unh bands more evenly spaced.

**vulcanus vulcanus, F.* India. C.

γ. ♂ upf orange markings reduced to a few streaks; ♀ plain dark brown. Below bands very wide.

vulcanus tavoyana, Evans. Tavoy. R.

3 (2). ♂ uph blue shot; ♀ with plumbeous scales on H and dorsal area F. Upf orange areas pale, restricted and suffused darker scales.

α. ♂ above pale blue shot only on H.

schistacea schistacea M. (28–37). The Plumbeous Silverline. Ceylon. S. India. NR.

β. ♂ above lower half F and all H pale blue shot.

schistacea gabriel, Swin. (30). N. Burma. R.

4a (2d). Unh sub-basal band broken into 3 spots, the upper 2 of which may be conjoined.

4b (9). Unf arrangement of sub-apical spots normal, outer spots in 4 and 6, inner spots in 5 and 7, each pair one above the other and conjoined; the inner edge of the spot in 6 may touch the outer edge of the spot in 5 thereby forming a rough V, submarginal line never continuous.

4 (5–6a). ♂ above iridescent pale blue, ♀ dull blue; no orange patches upf or plumbeous scales. Below pale brownish ochreous, bands concolorous with ground and faintly outlined black, silver centres prominent. Very variable.

lilacinus, M. (32–36.) The Lilac Silverline. Bangalore, Kasauli, Assam, Mhow, Malda, Hardwar. R.

5 (4–6a). ♂ above dusky violet brown at apex F, rest dull greenish grey, shot light blue. ♀ except for dark apex shining plumbeous silvery. Below dull reddish brown, markings very narrow.

abnormis, M. (40–44). The Abnormal Silverline. S. India. VR.

6a (4–5). ♂ above dark blue shot, ♀ dark brown, the blue colour more or less replaced by plumbeous scales.

6 (7a). Below brick red with well defined markings. ♂ above intense black, shot dark blue up to v3. ♀ upf with a small diffuse orange spot, the blue shot replaced by a slight dusting of blue scales.

nubilus, M. (27–32). The Clouded Silverline. Ceylon. R.

7a (6). Below not brick red.

7 (8). ♀ with plumbeous scales above. ♂ ♀ with a well defined triangular orange patch upf. ♂ upf blue shot area not above v2.

α. ♂ upf dark brown with a more or less well defined orange patch upf, large and extending into 2 in the WSF, small and obscure in the DSF; WSF only shot blue in 1, in DSF carried up into 2 and 3. Below pale yellow in WSF with well-defined markings, DSF khaki to reddish brown with markings tending to become obsolete.

H.56. Spindasis.—(*contd*).

ictis ceylanica, Fd. (27–32). The Common Silverline. Ceylon. C.

β. Larger. Upf orange patch well defined and almost invariably present. WSF below with very well defined dark bands : DSF khaki with bands nearly obsolete.

ictis ictis, Hew. (30–35). India. C.

8 (7). ♀ above no plumbeous scales. ♂ upf at most a small obscure orange patch ; in ♀ the patch is oval or circular, not triangular and does not extend below v3. Below khaki to reddish brown, markings well defined in WSF, faint in DSF. ♂ upf shot blue area above v2.

α. Comparatively small.

elima fairliei, Ormiston. (28–35). The Scarce Shot Silverline. Ceylon. NR.

β. Rather larger. Very variable.

elima elima, M. (32–38). India. R.

γ. Much larger.

elima uniformis, M. (36–42). Chitral—Kashmir. NR.

9 (4b). Unf sub-apical markings abnormal ; 3 outer spots in 4, 5 and 6 that in 5 slightly shifted in ; single inner spot in 7 midway between the outer spots and the discal band. ♂ above dark brown with a prominent orange patch upf, most of F blue shot, which colour extends over the orange area, presenting a peculiar appearance. ♀ dark brown, no plumbeous scales. Below khaki with narrow markings rather as in the DSF of *ictis*.

maximus, El. (35–42). The Karen Silverline. Shan States—Karens. NR.

10a (2c). Unf no costal markings above the scv, between the central cell bar and the base.

10b (13). Unf basal markings in cell as for 3c.

10 (11a). Unf sub-marginal line obscure, absent or discontinuous. Below bands very narrowly black-edged. Above dark brown, ♂ blue shot F and H ; ♀ with the blue shot replaced by plumbeous scales.

α. Below pale ochreous, bands concolorous or slightly darker than the ground, silver line often absent. ♂ ♀ with a more or less well developed orange patch upf, often absent.

nipalicus nipalicus, M. (36–42). The Silvergrey Silverline. Kulu—Nepal. R.

β. Below pale cinnamon red, bands darker, silver line obsolete, ♂ ♀ usually with a prominent orange patch.

nipalicus sani, DeN. Sikkim. R.

γ. Below as last, rather darker. ♂ upf darker, no orange patch. Below pale to dark cinnamon red, silver lines may be prominent ; lobe maroon or black ; discal band F and H more broken. ♀ above no orange, H and discal area F pale silver grey, scales closely set, not sparse as in other races.

nipalicus evansii, Tytler. Nagas Shan States—Karens. R.

11a (10). Unf submarginal line continuous and sharply defined.

11 (12). Below khaki with narrow dark bands. Above dark brown, ♂ shot blue and with no orange patch upf.

rukmini, DeN. (33–38). The khaki Silverline. Sikkim—Assam. VR.

12 (11). Below pale yellow, with broader black bands. ♂ shot blue, often with small orange spot upf : ♀ brown, with broad orange area.

elwesi, Riley (*MS*). Elwes' Silverline. Kumaon to Assam. VR.

13 (10b). Unf base cell with a continuous club-shaped streak. Above dark brown, no orange on F ; ♂ shot blue F and H. Below pale yellow with black bands to cinnamon red with red bands.

**syama peguanus, M.* (26–40). The Club Silverline. Orissa. Sikkim—Burma. C.

14 (2b). Unh sub-basal band continued along v1 to or nearly to the lower end of the central band, sometimes macular. Unf basal marking consists of a broad bar across the cell, the upper edge of which is joined to the base by a streak over the scv and on either side of it, which streak does not reach the central cell spot ; submarginal line usually continuous, but may be merged to the sub-marginal line ; sub-apical spots V shaped. Above as last.

α. Below bands very broad, ground colour pale yellow to reddish ochreous, bands usually red, very rarely black or nearly so, unh the sub-basal band in the DSF may not be continued along v1.

H.56. Spindasis.—(*contd.*)

lohita lazularia, M. (36–42). The Long-banded Silverline. Ceylon. S. India R.

β. Below pale yellow, bands black to red, very variable. Unf sub-marginal line wide and joined to the marginal line in the WSF., thin and macular in the DSF.

lohita himalayanus, M. (30–42). Sikkim—N. Burma. C.

γ. As last, but smaller. Unf submarginal line always narrow and continuous.

lohita seliga, Fr. (28–34). Karens—S. Burma. C.

δ. Below bands always black, submarginal line narrow and continuous. Unh sub-basal band always meets the central band.

lohita zoilus, M. (30–36). Andamans. NR.

H.57. Zesius.—The Redspot. (Plate 29.)

♂ above copper red outwardly darker and inwardly glosed violet with a fuscous border, 1mm. ; ♀ rather pale powdery blue, may be purple tinged, with broad borders of variable width ; uph with 2 tornal black spots, orange crowned in ♀. Below pale grey with white edged brown markings, turning reddish towards base, arranged as in *Amblypodia ;* discal bands fairly regular ; tornal spots black, crowned orange or entirely orange.

**chrysomallus, Hew.* (38–44). The Redspot. Ceylon. S. India. Orissa. NR.

H.58. Dacalana.—The Tufted Royal. (Plate 29.)

♂ above pale shining azure blue, border F ½mm.–5 at apex ; uph with a white patch mid costa ; ♀ paler, with a prominent white patch end cell F. Below rather pale brown, crossed by an even white band, central on F, discal on H and followed by a thin sub-marginal black line ; tornal lobe black and an orange crowned black spot in 2 with white scales between. ♂ unf with a tuft of white hairs mid dorsum ; uph brand above base 6 covered with blue scales and on a polished area.

1 (2). F v9 absent. Unh white band very narrow, just under 1mm. Considerable seasonal variation.

pennicilligera, DeN. (38–42). The Assam Tufted Royal. Assam—Dawnas. NR.

2 (1). F v9 present. Unh white band just over 1mm.

vidura burmana, M. (35–38). The Malay Tufted Royal. Dawnas-S. Burma. NR.

H.59. Pratapa.—The Tufted Royals. (Plate 29.)

Above blue with broad black apex F and H and borders F. Below pale brown to white with a thin discal line and tornal orange spots.

1 (2a). Below pale brown with a white band as in *Dacalana*, but broader and expanding towards the dorsum and costa. Above as *Dacalana ;* considerable seasonal variation in width of borders. ♂ unf tuft black ; brand uph dark brown, oval, on a polished area.

cotys, Hew. (33–37). The White banded Royal. Sikkim—N. Burma. NR.

2a (1). Below no white band. ♀ uph veins darkened.

2 (3a). Below polished silver grey with a discal series of separate black spots, broad bars end cells and a prominent spot mid 7 H. ♂ upf bright shining blue ; upf a large black spot bases 2 and 3 and another mid 1. ♀ pale purple blue turning whitish towards apex F. ♂ unf tuft brown ; dark brand uph on a black polished area.

* *ctesia, Hew.* (38–40). The Bi-spot Royal. Kumaon—Shan States. NR.

3a (2). Below a narrow dark discal line, no spots.

3 (4a). Unf discal line not below v2 ; unh upper bar of discal line in 7 shifted in. Below ♂ polished silver ; ♀ white with an ochreous tinge ; no bars end cells. ♂ above shining blue ; ♀ pale blue. ♂ unf tuft black ; uph brand large and dark.

α. ♂ above paler and greenish. Below discal line faint and macular.

lucida argentea, Aur. (37–42). The Silver Royal. S. India. R.

β. ♂ upf with blue streaks on the black apex. Uph blue extends into 6. Below discal line continuous.

lucida minturna, Fruh. (30–40). Sikkim-Dawnas. R.

H.59. Pratapa.—(*contd.*)

4a (3). Unf discal line continued to vl except in faintly marked specimens.

4 (5a). Below white, discal line macular, bars end cells faint ; unh upper bar of discal line in 7 shifted out. ♂ above shining blue, ♀ pale blue or purple blue, turning whitish outwardly on F. ♂ unf tuft black ; uph dark brand very large and conspicuous on a dark area.

α. ♂ above darker, border F straight to dorsum or nearly so. Below discal line often faint.

deva deva, M. (32–40). The White Royal. Ceylon, S. India—Central Provinces. R.

β. ♂ paler. WSF ♂ upf border prominently angled mid 1 and continued along dorsum.

**deva lila, M.* Mussoorie-Rangoon. NR.

5a (4). Unf discal line continuous, not macular.

5 (6a). Below pale grey with a white bar end cell, prominent on F. ♂ above shining deep blue. ♀ pale violet blue, white beyond end cell F. Lobe dark orange. ♂ unf tuft dark brown ; brand uph small and inconspicuous.

α. ♂ above blue restricted on F, just enters cell and not into 2, border angled mid 1 and continued to mid dorsum. ♀ uph all dark brown, powdered with violet blue scales.

icetas icetas, Hew. (30–37). The Dark Blue Royal. Kangra-Kumaon. R.

β. ♂ upf blue crosses cell and enters base 2 ; border angled mid 1 and continued ¼ along dorsum. ♀ uph violet blue.

icetas extensa, Evans. Sikkim-Karens. R.

γ. ♂ above blue paler and with a greenish tinge, much more extensive, entirely fills cell and extends to base 3 ; border not angled mid 1 or continued along dorsum.

icetas mishmia, Evans. Mishmi Hills. VR.

6a (5). Below no bars end cells.

6 (7). Below pale brown discal line on F inwardly curved at upper end, outwardly white edged. ♂ upf blue to base 4. ♀ above pale dull powdery blue, border broad and angled mid 1 on F, broad on H. ♂ unf tuft pale yellow ; uph brand large, but inconspicuous.

α. ♂ above shining purple blue ; H border 1mm.

* *icetoides carmentalis, DeN.* (30-32). The Blue Royal. Assam. NR.

β. ♂ above shining blue ; H border a thread. Unh tornal orange area large, portions in 1a and 2 united.

icetoides icetoides, El. Karens—S. Burma. R.

7 (6). Below creamy brown, unf discal line straight at costa, lower part curved, nearer end cell than termen. ♂ above pale shining blue, apex F very broadly black, but border reduced to a thread at tornus, no border H. ♀ pale purple blue. ♂ unf 2 tufts, inner long and black, outer short and white. Wings produced ; inner tail broad and ciliate.

cleobis, God. (27-38). The Broadtail Royal. S. India. Dun—N. Burma. NR.

H.60. Maneca.—The Slate Royal.

♂ above dull slatey blue, broad dark apices and border F, border H 2mm. and veins dark. ♀ slightly paler and border narrower. Lobe prominently ochreous and cilia white. Below greyish white with narrow bars ends cells and a macular discal line ; tornal markings H reduced. ♂ uph brand large and black.

bhotea, DeN. (26–27). The Slate Royal. Sikkim—Assam. R.

H.61. Britomartis.—The Baby Royals.

Very similar to *Pratapa*, but smaller. Body blue above. Below pale brown, discal line orange, no bars ends cells, marginal markings obscure ; tornal markings H prominent and a broad orange area.

1 (2). Unf discal line midway between end cell and termen ; unh orange at tornus in 1a and 2 not coalesced. ♂ above rather pale shining blue, black apex F extends into end cell and all space 3, border at tornus 1mm. and a thread on H. ♂ pale dull slatey blue, border not quite so broad as in ♂ and H costa and apex broadly dark brown. No ♂ brand.

buto, DeN. (32). The Baby Royal. Assam—Burma. NR.

2 (1). Unf discal line much nearer end cell than margin ; unh tornal orange in 1a and 2 coalesced. ♂ above shining cerulean blue, apex F reduced, inner

H.61. Britomartis.—(*contd.*)

edge curved, not straight. ♂ upf a large prominent patch of modified scales before end cell and in bases 2 and 3, which disappears with petrol.

cleoboides, El. (25–28). The Azure Royal. Karens—S. Burma. R.

H.62. Creusa.—The Black-branded Royal.

♂ above pale shining greenish blue, apex F broadly black reducing to 2mm at the tornus, bases 2 and 3 blue ; a black brand in outer half and cell ; H apex dark brown. ♀ paler and blue more extensive. Below very pale brown, no bars end cells, discal line dark ferruginous, on F nearer cell than termen ; H tornal markings small ; orange crowns separate and well separated from the discal band.

culta, DeN. (32). The Black-branded Royal. Assam. R.

H.63. Tajuria.—The Royals. (Plate 29.)

Very like *Pratapa* and the ♀ ♀ are hard to distinguish, but in *Pratapa* the veins on the hindwing are dusky, which is not the case in *Tajuria.*

1a (10a). Unh irrorated white scales in 1 extend sideways into 1a and 2 and sometimes into 3.

1b (5a). Below ochreous or ferruginous.

1 (2a). Unh tornal spots crowned by a metallic green line. ♂ above dark purple blue, very restricted. ♀ paler, blue colour enters 3 on F. Below ♂ dark chocolate, ♀ yellow to pale ferruginous.

α. ♂ upf blue in lower half of cell, basal ⅔ of 1a and 1.

jangala ravata, M. (32–42). The Chocolate Royal, Sikkim—Burma. C.

β. ♂ upf blue powdery, confined to basal ½ of 1a and 1.

jangala andamanica, WM. Andamans. NR.

2a (1). Unh no metallic green line over tornal spots.

2 (3a). Below yellow, no discal line ; unh tornal irrorated area surmounted by a white irregular line. ♂ above rich shining dark blue in 1a and 1 F and just entering cell ; H blue with broad dark border.

donatana, DeN. (32). The Dawna Royal. Dawnas. VR.

3a (2). Below discal line prominent and white edged.

3 (4). Unh a white irregular line over the tornal irrorated area. Below yellow, discal line unf about midway between the termen and end cell. Upf ♂ black : ♀ lower discal area pale blue.

α. ♂ uph costa only pale blue, extending to v5. ♀ blue just enters base 2 ; uph with only sparse blue scales about base to middle.

megistia megistia, Hew. (32–34). The Orange and Black Royal. Assam. NR.

β. ♂ uph all pale shining blue, except for narrow black termen. ♀ blue more extensive on F and H all blue except apex.

megistia thria, DeN. Dawnas—S. Burma. R.

4 (3). Unh no white line over the tornal irrorated area. Below chestnut, discal line unf much nearer end cell than termen.

α. ♂ upf black ; uph costa only pale blue, extending to v5 and into cell. Unf discal line sinuous.

yajna yajna, Doh. (34). The Chestnut and Black Royal. Mussoorie, Kumaon. VR.

β. As last, but uph blue costal area extends to v4 and into cell. Unf discal line straight. ♀ upf lower discal area and uph pale powdery blue.

**yajna istroidea, DeN.* (32–34). Sikkim—Assam. R.

γ. ♂ upf shining pale blue in 1a and 1, not reaching v1 ; uph all blue except for narrow terminal border. Below paler. Lobe above mostly fulvous.

yajna ellisi, Evans. (34). N. Shan States. R.

5a (1b). Below pale brown to brown sometimes rosy in No. 8. ♂ ♀ above pale blue except for costa and apex and termen F. ♀ upf denser black beyond end cell (except 7b).

5b (7a). Below with bars end cells F and H ; brown discal line midway between termen and end cell and area beyond paler ; unh upper end of discal line usually shifted out.

5 (6). ♂ shining green, on F in basal ½ of 2 and ⅓ of 3 ; ♀ blue in ⅔ of 2 and ⅓ of 3 ; uph lower ½ of 6 blue to termen and in ♀ basal ⅔ of 6 blue. Unh orange tornal spots prominent.

H.63. Tajuria.—(*contd.*)

mantra, Fd. (42-44). Felder's Royal. Tavoy—S. Burma. VR.

6 (5). ♂ pale non-shining blue, on F only to base 2 ; ♀ in ½ of 2 and ⅓ of 3. ♂ ♀ uph blue only in base of 6. Unh orange tornal spots very reduced.

oeeta, DeN. (47-48). DeNiceville's Royal. Karens—S. Burma. VR.

7a (5b). Below bar end cell absent on H and at most faint on F ; unf discal line nearer termen than end cell ; ground colour uniform.

7b (6). Below brown, discal line not prominently white edged. ♀ upf a prominent fuscous area of modified scales, disappearing with petrol, at and beyond end cell. ♂ upf blue in ⅔ cell, 1a and 1 ; in ♀ extending into 2 and 3.

7 (8). Unh discal line not conspicuously broken at v4. ♂ above pale shining greenish blue ; uph costa broadly dark brown, filling all 6 except extreme base.

ogyges, DeN. (47–48). The Large Branded Royal. Moulmein—S. Burma. VR.

8 (7). Unh discal line conspicuously broken at v4; below often rosy, especially in ♀. ♀ above pale blue.

melastigma, DeN. (40–46). The Branded Royal, N. Kanara, Kumaon—Burma. R.

9 (7b). Below very pale brown, discal line prominently white edged ; tornal orange markings H large. ♂ ♀ above pale blue, rather powdery, extending on F in ♂ into basal ½ or ⅓ of 2, in ♀ up to base 3 and most of 2 ; uph lobe orange crowned.

ister, Hew. (32–39). The Uncertain Royal. Assam. VR.

10a (1a). Unh tornal white irrorations confined to 1. Below white to pale brown, discal line not white edged.

10b (27). Unf no broad discal band.

10c (17a). Unh no spot on dorsum between end of discal line and base. Below with a narrow discal line, which may be absent.

10d (15a). Below discal line about midway between termen and end cell, continuous.

10 (11a). Unh discal line not parallel to termen, very straight and continuous to the middle of 2 from the costa. Below pale brown, discal line ferruginous, submarginal line prominent, no bars end cells. ♂ above pale blue in DSF, reaching base 3 ; WSF darker, blue more restricted ; ♀ paler, with a white spot beyond end cell F ; uph lobe mostly red.

diaeus, Hew. (33-36). The Straightline Royal, Mussoorie—N. Burma. R.

11a (10). Unh discal line parallel to termen, very irregular, brown. Below cell bars usually present. Uph lobe mostly black.

11b (14). Above pale cerulean blue ; ♂ upf blue in most of cell and to v3, terminal border narrow in 1a and 1 : ♀ blue very extensive. Below white to grey.

11 (12–13). ♂ above very pale cerulean blue, entering 3 upf ; ♀ area beyond cell upf prominently very pale.

albiplaga, DeN. (34–37). The Pallid Royal. Sikkim—Tavoy. R.

12 (11–13). Darker ; ♂ upf no blue in 3. Below darker, discal lines prominent, tornal spots reduced. Often no tail at v2.

sebonga, Tyt. (35). Tytler's Royal. Manipur. R.

13 (11–12). As last. Below paler, discal lines absent, tornal spots prominent. ♀ upf black apex broader, evenly curved, no tooth.

isaeus, Hew. (35). The Bornean Royal. S. Burma (DeN). VR.

14 (11b). Above dusky dark powdery blue ; ♂ upf blue colour may just enter 2, terminal border broad ; ♀ blue colour just enters base 3. Below pale brown : considerable seasonal variation.

thyia, DeN. (30–36). The Dusky Royal. Assam. R.

15a (10d). Below discal line much nearer termen than end cell, macular and may be absent ; pale grey to white, bars end cells present or absent ; on H discal line broken in at 3 and 4, so that lower part is shifted in compared to the upper part ; tornal markings more or less prominent. ♀ uph nearly always with a wavy black discal line.

15 (16). Above cilia conspicuously white. ♂ above slatey blue, on F in lower ½ of cell, basal ½ of 1a and 1, but may extend to base 3 ; on H there may be a wavy discal line as in ♀. ♀ upf blue more extensive, to beyond end cell where it is paler, sometimes whitish. ♂ ♀ uph 2 tornal black spots in 1 and 2.

H.63. Tajuria.—(*contd.*)

jehana, M. (30–37). The Plains Blue Royal. Ceylon. S. India—Bengal and Dun. NR.

♂. v. ceylanica, *Riley*, Blue upf extending above v2. NR.

16 (15). Cilia brown, or long hairs only white. ♂ above dark shining blue or greenish blue ; upf cell blue and may extend to base 3. ♀ greyish blue, becoming whitish outwardly on F.

α. Darker blue. Smaller.

* *cippus longinus*, *F.* (31–45). The Peacock Royal. Ceylon. C.

β. Brighter. Larger.

cippus cippus, *F.* India, Burma. C.

17a (10c). Unh a small black spot on dorsum between the end of the discal band and the base. Below white ; H tornal markings very reduced.

17 (18a). Unh no black spot in 8 internal to the discal band. Below bars end cells wide, discal line broken very irregular on H ; unh black spot at apex. Upf disc white, turning bluish at base and dorsum, broad black border extending along dorsum, bluish white scales at tornus ; uph bluish, turning white beyond end cell and base 6, rest of 6 dark brown to costa. ♀ as ♂ but wings more rounded.

* *illurgis*, *Hew.* (38–42). The White Royal. Mussoorie—N. Burma. R.

18a (17). Unh a black spot just below v8 between end cell and base.

18b (20). Below with a narrow irregular discal line, bars end cells narrow.

18 (19). Unf discal line in 1 not concave. Above as in last with white patches F and H.

illurgioides, *DeN.* (38–42). The Scarce White Royal. Mussoorie—Assam. R.

19 (18). Unf discal line concave in 1. Above ♂ pale blue, extending on upf to termen in 1 and filling basal ⅔ of 2. ♀ with broad dark border at termen upf and along costa uph ; upf blue colour extending to 3 and turning whitish on disc.

luculentus nila, *Swin.* (38–42). The Chinese Royal. Assam. VR.

20 (18b). Below no discal line, but with several large irregularly placed black spots. Above pale blue turning whitish on disc F and beyond cell H, with broad dark borders F and costa H, extending along costa F. ♀ white with borders as in ♂.

* *maculata*, *Hew.* (36–44). The Spotted Royal. Sikkim—Burma. NR.

21 (10b). Below white with a broad dark discal band, no bars end cells. Above ♂ shining violet blue, border 1mm to 3 at apex F. ♀ dark brown.

α. Lobe above mostly black. ♀ uph with a row of submarginal white spots. Below discal band dark brown, outwardly defined by a white line, diffused outwardly ; H a waved line above tornus quite separate from the tornal markings, black spot in 2.

jalindra macarita, *Fr.* (36–44). The Banded Royal. S. India. R.

β. As last. ♀ uph a white subterminal line in 1–2. Below discal band chocolate ; H tornal green scales more prominent ; white diffused areas beyond discal band more extensive.

**jalindra indra*, *M.* Orissa. Sikkim—Karens. NR.

γ. Lobe above mostly orange. ♀ uph no white spots. Below ground colour bluish white, discal band ferruginous brown, on F only separated from the marginal ferruginous area by a narrow white line to v2 ; H discal and marginal dark areas coalesced, no wavy discal line above tornus ; tornal orange very extensive.

jalindra tarpina, *Hew.* Andamans. NR.

H.64. Charana.—The Mandarin Blue. (Plate 29.)

1 (2). ♂ above pale blue, black apex fills ½ of cell and the dark border extends along the dorsum ; H costal border broad. ♀ above dark brown, tornal area H white with black spots. Below discal band ferruginous brown, confluent with paler ferruginous brown marginal area : marked as in H 63-21.

**mandarinus*, *Hew.* (40–44). The Mandarin Blue, Sikkim—Burma. Andamans. NR.

2 (1). ♂ above rich deep blue, much restricted. ♀ tornal white area uph reduced. Below border purple brown with no white submarginal line.

cepheis, *DeN.* (45). The Cachar Mandarin Blue. Assam. VR.

H.65. Jacoona—The Great Imperial.

♂ above pale shining blue at base F and H and a blue bar beyond the cell F on the black apex ; ♀ dark brown : uph tornal area white with two large black spots. Below white, apex F broadly and H narrowly silky ochreous ; unh tornal spots prominent and irrorated metallic scales, a very broken black discal line from 1a to 4. ♂ upf black brand on disc only showing with petrol.

anasuja, Fd. (46-50). The Great Imperial. N. Shan States.—S. Burma. VR.

H.66. Manto.—The Green Imperial.

♂ above bright shining greenish blue with a broad black apex F. ♀ dark brown with a broad white tornal area uph bearing black spots. Below ♂ chrome yellow outwardly darker ; ♀ paler ; H with prominent tornal spots.

hypoleuca martina, Hew. (44-47). The Green Imperial. Tavoy—S. Burma. R.

H.67. Mantoides—The Brush Imperial.

♂ ♀ above dark brown with a broad white tornal area uph, bearing black spots. Below silky ; F dorsum broadly white, remainder ochreous, darkening towards apex ; H white, costa and apex ochreous ; a discal black line, very obscure on F and prominent tornal spots H.

licinius, Druce. (36-44). The Brush Imperial. Dawnas—S. Burma. VR.

H.68. Neocheritra.—The Grand Imperials. (Plate 29).

1 (2). ♂ upf base shining pale blue, apex dark brown, inwardly angled and there may be a white patch in 2 ; uph dark brown, tornal area broadly white, crowned by some scattered blue scales and bearing black spots. ♀ dark brown with sometimes a white discal patch F ; H tornal area as ♂. Below white, apices ochreous brown, broad in F and bearing two suffused white fasciæ, narrower on H and bearing one white fascia : H with an irregular discal line from 1a to 2 and prominent tornal black spots, sprinkled with metallic blue scales.

**fabronia Hew.* (37-44). The Pale Grand Imperial. Sikkim—Burma. R.

2 (1). ♂ above dark purple blue with broad black apex F and border H tornus whitish, with a black spot in 1. ♀ dark brown with the tornus H white, bearing two confluent black spots. Below white with unmarked bright ochreous apices and the usual tornal markings H.

amrita, Fd. (35-50). The Dark Grand Imperial. Karens—S. Burma. VR.

H.69. Purlisa–The Giant Imperial.

♂ above shining blue with broad black apex F and border H. Below dark ashy with a darker postdiscal band and submarginal lunules ; tornal area sprinkled metallic scales.

gigantea, Dist. (52). The Giant Imperial. S. Burma. VR.

H.70. Suasa.—The Red Imperial. (Plate 29.)

♂ upf orange with black apex and border, base powdered bright blue scales, veins black ; uph pale blue with black apex and costa, black tornal spots in 1a and 2. ♀ upf orange with dark brown apex and border and base broadly darkened ; uph dark brown with tornal white area, bearing black spots. Below white ; F a broad ochreous brown discal band from costa to v3 continuing to v1, as a narrow brown line, margin broadly ochreous brown ; H a prominent black spot in 7 near base in ♂ only, a narrow discal and submarginal brown line, ending in prominent black spot in 7, prominent tornal spots.

**lisides, Hew.* (27-30). The Red Imperial. Assam—Burma. R.

H.71. Cheritrella.—The Truncate Imperial. (Plate 29.)

♂ upf dark purple blue with broad black apex and border ; uph pale shining blue with broad dark brown borders, lobe ochreous. ♀ much paler blue with two discal white spots upf. Below rather pale ochreous brown with darker markings, few and obscure on F, numerous on H ; tornal markings H absent except for some white irroration.

truncipennis, DeN. (32-36). The Truncate Imperial. Sikkim—Karens. R.

H.72. Neomyrina.—The White Imperial. (Plate 29.)

♂ ♀ above white with broad black apex F, shot blue in ♂. Below white with broad grey, black edged, markings arranged as in *Amblypodia* and with tornal black spots, crowned with metallic green scales.

**hiemalis, God.* (50–58). The White Imperial. Dawnas—S. Burma. NR.

H.73. Cheritra.—The Common Imperial. (Plate 29.)

♂ ♀ above dark brown with a purple tinge in ♂; a white tornal area H, bearing black spots. Below very faint bars at ends of cells; a narrow discal line F; a discal and submarginal line H and tornal black spots. Crowned metallic scales.

α. Below pure white, apex F faintly tinged ochreous; unf discal line black, highly waved and macular.

freja pseudojaffra, M. (38–42). The Common Imperial. Ceylon. NR.

β. Unf discal line regular and continuous. Uph white area more extensive.

freja jaffra, But. S. India. NR.

γ. Below ♂ pale ochreous, darkening at apex and termen F and apex H. ♀ white, outwardly ochreous. Unf discal line ochreous.

**freja freja. F.* Kumaon—Tavoy. NR.

δ. Below ♂ ♀ white; ♂ costa narrowly, apex and termen broadly bright ochreous; ♀ the ochreous apex unf very wide. Unf discal line ochreous.

freja regia, Evans. Mergui. C.

H.74. Ticherra.—The Blue Imperial.

♂ above dark purple blue, border 1mm; black tornal spots H coalesced and crowned by two white spots. ♀ dark brown. Below WSF bright ochreous, faintly marked as in *Cheritra*; DSF pale brown, markings more prominent and some obscure central markings.

acte, M. (34–38). The Blue Imperial. Kumaon—Burma. NR.

H.75. Biduanda.—The Posies. (Plate 29.)

1a (3a). Unf white, discal band not of same width throughout and broken in middle; unh upper spot of discal band in line with rest. Unf prominent chocolate spots in cell, narrow ferruginous or brown line end cell and a chocolate discal band, which is very wide to v3 and merges into the chocolate apex; margin below v3 ochreous, inwardly edged by a dark line. Unh white with basal brown rings or spots, an irregular double discal line, the upper end of which is darker and filled in as a single line, a very narrow submarginal line; prominent black spots and metallic scales. Tails v1 4 mm, v2 7mm, ♀ v3 1½mm; no ♂ brand.

1 (2). Unf discal band well separated from line end cell; a narrow dark line beyond upper part of discal band, the outer edge of which and of the discal band is obscurely white edged; the discal band in 2 consists of 2 narrow chocolate or ferruginous lines, which may coalesce, and in 3 of 2 chocolate lines, which are often coalesced. ♂ above dark brown; costa H orange and tornal area broadly pale shining blue with black marginal spots in 1a and 2.

α. Below markings not so pronounced and paler. ♂ above paler; upf with a sharply defined white patch at bases 2 and 3. ♀ dark brown with an orange discal patch on F and some faint tornal grey scales H.

melisa cyara, Hew. (20–25). The Blue Posy. Sikkim—N. Burma. VR.

β. Below strongly marked. ♂ upf no white patch. ♀ dark brown with a small orange spot end cell F, which may be obsolete or diffused; pale tornal area of variable extent and colour from bluish to white and more or less divided by darker veins.

**melisa melisa, Hew.* Karens—S. Burma. NR.

2 (1). Unf upper part of discal band coalesced to upper part of bar end cell and to line beyond, outwardly edged by a narrow, clearly defined, irregular white line; discal band in 2 consists of a single ochreous line and in 1 of a single chocolate line (or 2 spots); submarginal line regular, not waved, widened inwardly in 1 nearly to the discal band. Unh 2 narrow single lines at end cell (in *melisa* there is an outer narrow line and an inner double line, which may be coalesced). ♂ above dark shining violet blue, border 1mm, tornal spots in 1 and 2 crowned by bluish white scales. ♀ dark brown, a prominent orange discal spot on F; a broad bluish white tornal area H, which is not divided by darker veins.

H.75. Biduanda.—(*contd.*)

nicevillei, *Doh.* (30–33). The Violet Posy. Tavoy—S. Burma. R.

3a (1a). Unf ochreous, apex broadly washed brown, markings brown on the brown area, ochreous elsewhere ; discal band of even width, unbroken. Unh very like 1 a, but upper part of discal band in 7 shifted in to over cell bar. Unf spot base cell, bars mid and end cell. ♀ dark brown, a broad orange discal patch F and bluish tornus H.

3 (4). ♂ no brand. Above dark brown ; upf with an orange discal patch, beyond which the apex is deep violet blue, sparsely frosted white scales ; uph termen and tornus frosted white scales, mixed anteriorly with blue scales. Tails v1 2mm, v2 5mm, v3 1mm.

scudderii, *Doh.* (27–30). The Frosted Posy. Dawnas to S. Burma. VR.

4 (3). ♂ uph a shining dark brown brand about base 6 and shining yellow beyond. ♂ above dark violet blue, no border ; a more or less obscure or obsolete reddish discal patch on F. Tails v1 4mm, v2 10mm, v3 in ♀ 2mm.

**thesmia fabricii*, M. (32–35). The Dark Posy : Dawnas—S. Burma. NR.

β. ♂ upf, discal red patch more prominent ; ♀ orange red area more restricted. Unf apex not brown washed.

thesmia thesmia, *Hew.* S. Mergui. R.

H.76. Marmessus.—The Common Posy. (Plate 29.)

Upf orange red, base and apex dark brown ; ♂ uph pale shining blue, becoming purple towards apex and cerulean towards tornus ; ♀ uph dark brown with a more or less prominent orange discal patch. Below as H 74.4, but unf all ochreous and unh upper part of discal band in 6 and 7 shifted in, apex broadly pale ochreous. Tails v1 4mm, v2 10mm, v3 2mm.

**lisias boisduvali*, *M.* (26–30). The Common Posy. Karen—S. Burma. C.

H.77. Eoxylides.—The Branded Imperial.

Above dark brown ; ♂ upf some sparse blue scales above mid dorsum ; uph a broad white tornal area to v5, lobe black and two confluent tornal black spots, the white area edged bluish in ♂. Below bright ferruginous : F unmarked ; H tornal area as above, an irregular black discal line and a white bar end cell. Tails v1 2mm, v2 10mm, v3 2mm.

tharis, *Hub*, (34–36). The Branded Imperial. S. Burma. VR.

H.78. Thamala.—The Cardinal. (Plate 29.)

♂ above brilliant deep scarlet ; upf a dark border and some of the veins black. ♀ dark brown ; a large central orange area F intersected by a broad dark brown streak from base running below cell ; uph tornus widely irrorated bluish scales. Below crimson overlaid ochreous scales, obscure bars end cells a narrow dark obscure waved discal line ; tornal markings reduced and some sparse white scales. There is a second form of underside, ochreous not overlying crimson scales ; dusky in ♂ and markings obscure ; clear in ♀ and markings prominent. Tails v1 2mm, v2 3mm in ♂ ; in ♀ v1 3mm and v2 7mm.

miniata, *M.* (34–36). The Cardinal. Bhamo—S. Burma. NR.

H.79. Rathinda.—The Monkeypuzzle. (Plate 29.)

♂ ♀ above dark brown ; a white spot end cell F continued into 2 and 3 ; 2 black tornal spots H crowned by a dark ochreous fascia. Below ochreous brown to white ; on F some irregular dark basal markings, a curved white discal band, beyond which the apex is ochreous brown, bearing a white submarginal line ; H covered with numerous irregular markings. H angled at v4. Tails v1 2mm, v2 6mm, v3 2½mm.

* *amor*, *F.* (26–28). The Monkeypuzzle. Ceylon. S. India.—Assam. NR.

H.80. Horaga.—The Onyxes. (Plate 29.)

Mostly cyaneous blue above with a dark blue apex F and a prominent white discal patch. Below ochreous or brown with a prominent white discal band across both wings to middle of 1 on H, whence to the dorsum there is a metallic green line ; tornal markings prominent and crowned by a metallic green line, which may run to costa. ♂ in Nos. 1 and 2 has an oval ochreous brand along basal half of v1, dorsum bowed. Tails v1 2mm, v2 4mm, and v3 1mm.

1a (3a). Unf ♂ with a well defined brand. Unh white band well defined.

H.80. Horaga.—*(contd.)*

1 (2) ♂ ♀ above cyaneous blue, but shade is very variable. Unf either the white band or the dark line bordering it outwardly extends well above v6.

α. Upf blue colour paler and brighter, extending well beyond the end of the discal white patch in 2 and 3 ; white patch not into 1 ; H blue to termen. Unf discal band to costa. Unh discal band of even width. Below ochreous to ochreous brown. Tail at v3 nearly obsolete.

onyx cingalensis, *M.* (30–33). The Common Onyx. Ceylon—S. India. R.

β. Upf blue colour darker, but very variable, never extending beyond the discal white patch, which always enters 1 ; very variable below. Tail at v3 short.

* *onyx onyx*, *M.* (27–31). Kangra—S. Burma. NR.

γ. ♂ upf white patch small, divided by black veins and not below v2 ; blue colour absent or restricted to powdery scales at base ; H greenish. ♀ white patch very large ; base sprinkled dull blue scales ; H all brown. Below dark ochreous brown. Tail at v3 comparatively long.

onyx rana, *DeN.* (30–33). Andamans. NR.

2 (1) ♀ above shining violet. ♂ upf white patch very small, 1½mm. Below ochreous brown, white band very narrow and straight and on F neither the white band nor the dark line bordering it extend above v6.

halba, *Dist.* (28–30). The Malay Onyx. Mergui. VR.

3a (1a). No ♂ brand. Unh white band very narrow and sullied. Unf discal band never above v6.

3 (4). Unh white band diffused outwards, straight. ♂ upf dark brown, white patch nearly to v1 ; H shining violet nearly to termen. Below dark ochreous brown, outwardly paler.

albimacula, *Wm.* (25–27). The Violet Onyx. Andamans. VR.

4 (3). Unh discal band not diffused outwards, somewhat convex. ♂ ♀ above dark brown or violet brown, discal white patch F may extend into 1. Below uniform, rather dark brownish ochreous.

viola, *M.* (22–28). The Brown Onyx. S. India. Kangra—Burma. R.

H.81. Catapoecilma.—The Tinsels. (Plate 29.)

Termen scalloped and cilia prominently chequered ; H not angled, lobe ill developed also tornal markings below. Tails v1 1mm, v2 4½mm and v3 1½mm.

1a (3). Below with numerous more or less regular ochreous bands and spots, edged metallic green and black.

1 (2). Below rather pale brown, bands and spots comparatively irregular, upper part of discal band on F broken up and post discal band beyond highly irregular ; on H spots at base and mid 7 separate. ♂ above dark violet blue, border 1mm. ♀ pale violet blue, border broader.

α. In ♀ borders above narrower and inwardly scalloped along termen F.

elegans myositina, *Fruh.* (28–32). The Common Tinsel. Ceylon, S. India. R.

β. Borders broader ; in ♀ 3mm and inwardly even along termen F.

**elegans major*, *Fruh.* Orissa. Mussoorie—Burma. NR.

2 (1). Below bright ochreous, bands and spots regular. Above as last.

subochracea, *El.* (27–29). The Yellow Tinsel. Nagas—Tavoy. R.

3 (1a). Below no regular spots or bands ; chrome yellow, densely and evenly striated with black and bearing scattered greenish silver metallic scales and streaks. ♂ above smoky purple black, obscurely violet shot ; on F near base there may be some powdery dull blue scales ; ♀ as No. 1.

delicatum, *DeN.* (32–35). The Dark Tinsel. Sikkim—Assam. R.

H.82. Chliaria. The Tits. (Plate 29.)

1a (3). Unh a prominent black spot in 7 towards base ; unf discal band completely broken at v4.

1 (2). Unf small black costal spot above mid cell. ♂ above pale blue with broad black apex and termen F, narrow black costa and apex H ; the black apex F shot deep purple blue ; blue colour Fof very variable extent. ♀ brown, lower part of disc F may be whitish ; H tornal area broadly blcish white and veins darkened. Below white, faint bars end cells, making ochreous, black edged ; upper part discal band on F much wider than lower part ; discal band on H broken in 4 and 6 ; tornal spots prominent, orange crowned. Tails delicate, v1 4mm and v2 2mm.

H.82. Chliaria.—(*contd.*)

othona, Hew. (24–27). The Orchid Tit. South India. Dun—Burma. Andamans. NR.

2 (1). Unf no spot on costa. ♂ above pale blue, broadly black bordered, the inner portion of the border shot iridescent purple blue. ♀ dark brown, discs whitish. Below pale grey, marking concolorous and black edged. Tails v1 3mm and v2 1½mm.

α. Unh upper spot of discal band black. ♂ blue colour very restricted.

kina kina. Hew. (26–29). The Blue Tit. Dun—Kumaon. R.

β. Unh upper spot of discal band as rest. Blue colour very variable.

**kina cachara, M.* (27-31). Sikkim—Dawnas. NR.

3 (1a). Unh no spot in 7 towards base. ♂ above dark purple blue, except for black apex and border shot shining purple. ♀ brown, prominent white tornal area H, bearing marginal black spots. Below faint bars end cells ; discal band narrow, ochreous, white edged, placed much nearer end cell than margin, straight and continuous on F, broken sharply on H at v4 ; very little orange at tornus.

α. Larger. Below white, apex F broadly ochreous. Tails v1 8mm and v2 4mm.

merguia watsoni, Swin. (27–29). The Purple Tit. Chin-Karens. R.

β. Smaller. Below grey, apex F broadly pale ochreous. Tails v1 8mm and v2 4 mm.

merguia merguia, Doh. (21–24). Dawnas—S. Burma. R.

H.83. Hypolycaena.—The Tits. (Plate 29.)

1a (3). Unh a prominent spot in 7 near base. Tails v1 5mm v2 4mm.

1 (2). Unh basal spot in 7 black. ♂ above dark reddish purple brown ; ♀ dark brown, obscure black tornal spots H, crowned deep orange. Below white, faint bars end cells ; black edged obscure ochreous discal band, broken at v4 on F and H and upper part wider ; small tornal spots, obscurely yellow crowned.

nilgirica, M. (28–32). The Nilgiri Tit. Ceylon, S. India. R.

2 (1). Unh basal spot in 7 ochreous. Above very dark shining brown. ♂ paler and duller, prominent orange crowned tornal spots H. Below white, all markings narrow ochreous, white edged.

α. Uph spot in 2 only crowned ochreous. Unf discal band slightly shifted in at v4, apex broadly and margin narrowly ochreous ; unh discal band broken at v4 and slightly at v6 : tornal markings prominent, space 1 mostly ochreous.

**thecloides thecloides, Fd.* (30–32). The Brown Tit. Tavoy—S. Burma. R.

β. Uph ochreous tornal area wider, from 1a to 3. Unf discal band straight, termen only narrowly ochreous. Unh discal band straight to v4 : ochreous crown to spot in 2 prominent, but hardly spreading sideways, space 1 being mostly dark.

thecloides nicobarica, Evans. (31–33). Nicobars. R.

3 (1a). Unh no spot in 7 near base. ♂ above changing from black to shining purple except for black borders. Upf prominent black area of modified scales on disc. ♀ above dark brown ; uph an obscure white disconnected discal fascia in 1–3 : tornal spot in 2 prominently white edged and a narrow white submarginal fascia in 3–4. Below grey with faint ochreous tinge, double bars end cells ; an ochreous, white edged, discal line, continuous on F, broken on H at v4 and v6, tornal spot in 2 prominent, ochreous crowned. Tails v1 6mm and v2 5 mm.

α. Smaller. In ♀ uph tornal spot in 1 hardly defined.

erylus himavantus, Fruh. (32–36). The Common Tit. Sikkim—Burma. C.

β. Larger. In ♀ uph tornal spot in 1 defined by white edging.

erylus andamana, Fruh. (34-38). Andamans. NR.

H.84. Zeltus.—The Fluffy Tit. (Plate 29.)

♂ above very pale blue, powdery on F and confined to base ; the broad black apex F and H shot deep purple. ♀ dark brown, tornal spots in 1a and 2 prominently white ringed and on a white area. Below bluish white, apices broadly pale ochreous brown, markings darker ; double lines end cells ; a narrow discal line, continuous on F, broken at v3, 4 and 6 on H ; prominent black costal spot near base 7 ; tornal spots prominent, but not crowned orange. Tails fluffy at v1 13mm, at v2 7 mm.

* *etolus, F.* (28-32). The Fluffy Tit. Sikkim—Burma. NR.

H.85. Artipe.—The Green Flash. (Plate 29.)

♂ above shining blue, black bordered; ♀ dark brown; lobe green, black centred. Below verdigris green with a narrow white discal line and end cell bars; in ♀ tornal area H broadly white.

eryx, L. (♂ 40, ♀ 56). The Green Flash. Sikkim—Burma. Andamans. R.

v. skinneri, Wm. Below yellow. VR.

H.86. Deudoryx.—The Cornelians. (Plate 29.)

♂ above red with broad dark brown border, ♀ brown with sometimes the disc F paler. Below with cell bars and a discal band; H lobe black, orange crowned, a black spot in 2 and some metallic scales in 1. Above lobe black centred.

1 (2). Below markings very broad, continuous. Below uniform brown, markings white edged. ♂ scarlet above.

α. Smaller. Below rather dark brown.

epijarbas epijarbas, M. (34–38). The Cornelian. Ceylon, S. India—Orissa. NR.

β. Larger. Pale brown below.

epijarbas ancus, Fruh. (38–43). Chitral—Kumaon. NR.

γ. Very variable; usually rather dark brown below.

epijarbas amatius, Fruh. (36–44). Sikkim—Burma, Andamans, Nicobars, C.

* *v. diara, Swin.* Below very dark brown, outer part of the disc F and upper half H white, crossed by black veins. R.

2 (1). Below pale polished grey, outwardly pale ferruginous; markings narrow, catenulated, prominently white edged, slightly darker than the ground, of separated spots on F, conjoined on H; discal band H much nearer margin and upper spot in line. ♂ above paler red; ♀ may have a pale red discal area on F.

α. Below markings prominent, complete.

hypargyria gaetulia, DeN. (40–44). The Scarce Cornelian. Assam—N. Shan States. R.

β. Below markings becoming obsolete and may be reduced to spots in 2, 3, 4H.

hypargyria hypargyria, El. Karens. VR.

H.87. Virachola.—The Guava Blues. (Plate 29.)

Below markings broad, bars end cells more or less white edged, discal band and tornal markings as in *Deudoryx.*

1 (2). Below pale brown, markings slightly darker; no spot in cell F nor near base 7 H. ♂ above dark fuscous brown sometimes paler on disc, shot brilliant violet blue on lower part of disc F and on most of H; tornal spot in 2 usually present and some bluish scales between it and the lobe. ♀ paler fuscous brown, darker towards end cell F, beyond which there is an ochreous patch and sometimes a similar tornal patch; H marginal spot in 2 usually prominent and orange crowned.

isocrates isocrates, F. (40–44). The Common Guava Blue. Ceylon, India, C.

β. Termen F convex in ♂. ♂ above dull purple, glossed pink. Below rich dark vinous buff, markings very obscure.

isocrates rosacea, Tytler. Manipur. R.

2 (1). Below very variable, pale to dark brown, often purple washed; markings darker than ground, centrally brown, outwardly black and more or less white edged; discal band on F anteriorly oblique and may be broken at v4; a spot in cell. H nearly always with a prominent spot base 7. ♂ above blue with a broad dark brown border F, much blacker in cell, beyond which there may be a dark ochreous patch. ♀ blue colour paler and more extensive, a whitish or pale ochreous patch beyond cell F.

α. ♂ above pale, shining blue. ♀ pale blue, white patch diffused. Below dull, markings less prominent.

perse ghela, Fruh. (48–52). The large Guava Blue. Ceylon, S. India. NR.

β. Darker, but very variable above and below. ♀ upf white patch smaller, not diffused. Unf very rarely a spot in cell. ♂ unf a brand above mid v1.

H.87. Virachola.—(*contd.*)

perse perse. Hew. Kangra—Assam, Orissa. N. Burma. NR.

γ. Unf always a spot in cell. Upf ♂ ♀ ochreous or white patch absent.

perse smilis, Hew. Andamans. S. Burma. R.

H.88. Rapala.—The Flashes. (Plate 29.)

Normal pattern below consists of a bar end cell and a discal band followed by a more or less distinct submarginal line ; tornal spots more or less distinct, Nos. 1–3 are abnormal.

1a (7a). ♂ uph brand fills base of 6 or (in Nos. 5, 6 and 6a) has a detached portion along the base of v6.

1 (2a). ♂ uph brand enters cell. ♂ above dark indigo, shot brilliant deep blue, borders broad ; ♀ shining indigo blue with narrower border. Below purple brown, washed shining purple and bearing a number of large, white ringed, dark spots ; F spot in cell, double spot end cell, 3 discal and 3 apical spots ; H 2 costal spots in 7, inner one very large, spot in cell double, spot end cell and discal row. ♂ brand shining dark blue ; tuft brown, prominent.

subguttata, El. (32–35). The Spotted Flash. Karens—S. Burma. R.

2a (1). ♂ uph brand not into cell. Below banded, not spotted.

2b (4). Below pattern abnormal.

2 (3). Below rather pale brown, marked with narrow white lines ; F line near end cell, continued into 1, a pair of discal lines joined at the lower end, a short apical line and lunular submarginal lines ; H line through centre of cell from 1–8, a discal pair, broken at 1, a postdiscal line and 2 submarginal lunular lines ; prominent tornal black spots, crowned orange and metallic scales. ♂ above brilliant shining blue, confined to base on F. ♀ dull pale purple blue, bases darkened and borders broad. ♂ brand small, pale grey in centre of polished patch ; tuft black, prominent.

kessuma deliochus, Hew. (30–33). The Whiteline Flash. Shan States–S. Burma. VR.

3 (2). Below yellowish white, F and H a very large greenish white patch end cell and a very broad discal band, margins greenish brown ; tornal markings small, no orange. ♂ above dark shining purple, shot brilliant blue on H. borders black on F. ♀ unknown. ♂ brand pale brown, circular, behind origin v7 and with a detached portion at base 6 ; tuft brown, short.

**abnormis, El.* (30–33). The Abnormal Flash. Karens—S. Burma. R.

4a (2b). Below pattern normal.

4b (6b). ♂ unf tuft mid dorsum.

4 (5–6a). Below very pale brown, markings obscure, broad, white edged either side. ♂ above shining purple blue, broad black border on F. ♀ paler duller and border narrower. ♂ brand dark brown, elongated, runs along over v7 and fills base 6 ; tuft pale brown inconspicuous. Apex F and tornus H more produced than usual.

refulgens DeN. (31–33). The Refulgent Flash Assam—Karens. VR.

5 (4–6). Below bright ferruginous with a dark ferruginous discal band, normally placed on H, but on F just beyond end cell ; no bars end cells ; tornal markings reduced, but crowned powdery white scales. ♂ above purple brown, shot deep blue at base F and over most of H ; ♀ pale ferruginous ; lobe ferruginous. ♂ brand pale yellow, circular, above origin v7 and with a detached portion along the SCV between origins vs 6 and 7 ; tuft brown, inconspicuous.

lankana, M. (38–41). The Malabar Flash. Ceylon. S. India. R.

6a (4–5). Below bright ochreous. ♀ paler ; discal line narrow, brown, outwardly white edged and on F curved in at upper end. ♂ above red, broad border F running from 1a along dorsum ; black border F and red area H shot rich purple. ♀ brown. ♂ brand as in last ; tuft pale ochreous to ferruginous.

α. ♂ above coppery red. ♀ often paler on disc upf. Below pale yellow. Very variable.

**suffusa suffusa. M.* (33–37). The Suffused Flash. Assam—S. Burma. NR.

β. ♂ above bright red, not entering cell F and veins not black ; H cell and dorsum and veins black ; ♀ cupreous on disc. Below ♂ coppery ochreous ; ♀ pale yellow, markings prominent ; tornal spot in 2 crowned ochreous.

suffusa rubicunda, Evans. (33–35). Andamans. R.

6b (4b). ♂ unf no tuft mid dorsum ; brand uph as in No. 6a, but smaller. Above dull red with broad fuscous borders F and dusky veins ; the red colour

H.88. Rapala.—(*contd.*)

may be more or less fuscous overlaid, especially in ♀. Lobe small, ochreous. Below pale brown, single white bars end cells, discal bands rather broad, slightly darker than ground, white edged outwardly and on F much curved in apically ; on H curved parallel to termen. ♂ tornal spots in 2 prominent, orange crowned.

hades, *DeN.* (39-44). The Malay Flash. Dawnas—S. Burma. VR.

7a (1a). ♂ uph brand entirely above v7 and mostly behind its origin.

7 (8a). ♂ unf large polished area mid dorsum ; brand brown, large, circular ; tuft dark brown, prominent ; upf a black discal patch of modified scales.

♂ above very dark blue, shot brilliant deep blue ; ♀ dull purple, shading to the dark brown border. Below ♂ DSF greenish ochreous, WSF ochreous brown ; ♀ bright ochreous ; discal line narrow, outwardly white edged, broken on H.

tara, *DeN.* (33-41). The Assam Flash. Kumaon—Assam. NR.

8a (7). ♂ unf no polished area.

8b (16a). Unh discal band more or less curved and parallel to termen.

8c (12a). ♂ above blue.

8 (9a). Below bands very dark brown, broad, not white edged ; ground colour variable from uniform pale to dark ochreous brown, bases often darker. Body below prominently ochreous. ♂ above dark blue, shot most brilliant rich deep blue, border F broad. ♀ above rich shining blue, veins black. ♂ brand as No. 7 ; tuft dark brown, broad.

α. Upf no brand in ♂. Variable with the season.

sphinx sphinx F. (36-38). The Brilliant Flash. Assam—Rangoon. R.

β. Upf a sharply defined brand at bases 2 and 3 in ♂.

sphinx rhoecus, *DeN.* S. Shan States—S. Burma. R.

9a (8). Below bands white edged ; unh band white edged both sides and lower edge cell bar touches the discal band or nearly so ; tornal markings prominent, spot in 2 orange ringed and crowned.

9 (10a). Unf discal band double, comparatively broad and white edged on both sides. ♂ above dark shining greenish indigo blue, shading on F to a shining black border ; not shot blue. ♀ pale shining steely blue, more or less purple glossed. Below from slatey brown, often with a purple or greenish gloss to nearly white in the DSF ; markings always darker than the ground, sometimes as narrow as in No. 10 or so wide that the discal band coalesces with the cell bars. ♂ brand pale brown, circular ; tuft black or dark brown ; upf bases vs. 2, 3 and 4 denuded of scales and more or less darkened.

α. Smaller, paler and narrower banded below.

varuna lazuliua, *M.* (28-32). The Indigo Flash. Ceylon, S. India, NR.

β. Similar. Very pale below.

varuna grisea, *M.* (28-32). Kangra—Kumaon, R.

γ. WSF always larger. Very variable above and below, often very broad banded.

varuna orseis, *Hew.* (29-35). Sikkim—Burma. Andamans. NR.

δ. unh tornus broadly white powdered.

varuna rogersi, *Swin.* (32). Nicobars. R.

10a (9). Unf band single, only white edged outwardly. ♂ above dark slatey blue, shot more or less brilliant deep blue. ♀ as No. 9, rather darker and more purple. ♂ brand as No. 9, darker ; tuft dark brown.

10 (11). Below pale brown to slatey brown, sometimes with a purple wash ; ♀ sometimes ochreous brown. ♂ above shot on lower part of disc F and most of H. Considerable seasonal variation.

schistacea, *M.* (30-33). The Slate Flash. Ceylon. India—Burma. Andamans. C.

11 (10). Below very pale greenish grey. ♂ above only shot blue on H.

scintilla, *DeN.* (30-32). The Scarce Slate Flash, Sikkim—Burma. R.

12a (8c). ♂ above some shade of red. ♀ dull blue, brown coppery or red.

12b (14a). Below some shade of ochreous. ♀ dull blue or brown.

12 (13). ♂ above coppery red. ♀ dull blue or purple blue shading to fuscous. ♂ brand pale grey, oval : tuft brown.

α. ♂ above dark copper red colour extensive, border not continuing along dorsum F ; H red to termen, lobe ochreous. Below ochreous brown, markings dark brown, white edged outwardly ; unf a spot in cell nearly always

H.88. Rapala—(*contd.*)
present in ♂, usually absent in ♀ ; unh a spot near base 7 nearly always present in ♂.

**pheretimus petosiris, Hew.* (38–42). The Copper Flash. Sikkim—Burma. NR.

β. ♂ above darker, copper red area F confined to a patch in middle of disc and very restricted on H ; ♀ dull shining blue ; lobe black. Below darker, discal bands more irregular ; unf spot in cell present in ♂, absent in ♀ ; unh ♂ no spot in 7.

pheretimus pheretimus, Hew. (36–40). Victoria Point, S. Mergui. NR.

13 (12). ♂ above bright scarlet, may be very obscurely purple shot ; border broad and continued along dorsum F ; H base and dorsum broadly black ; lobe ochreous. ♀ plain brown. Below coppery ochreous of a variable shade, markings narrow, tornal spot in 2 ochreous crowned. ♂ brand pale ochreous, brown or grey, small and oval ; tuft brown.

α. ♂ above red colour extends into 4 F ; veins more or less black. Below DSF pale brownish ochreous ; WSF coppery ochreous.

dieneces dieneces, Hew. (30–36). The Scarlet Flash. Bengal. Assam—Burma. NR.

β. ♂ above red colour not above v4 on F ; vs F not black, on H all black and red colour of equal extent in 6 and 5. Below darker, copper brown.

dieneces intermedia, Stg. Andamans. NR.

14a (12b). Below slatey grey, no ochreous tinge. ♂ brand dull brown, not conspicuous. In ♂ dark border on F not continued along dorsum.

14 (15). ♂ above bright red ; shot purple ; border broad and vs F black, but not markedly so ; WSF duskier and border broader. ♀ paler red. Lobe black with a few orange and metallic scales. Unh tornal spot in 2 not prominent nor orange crowned.

melampus, Cr. (33–38). The Indian Red Flash. Ceylon, S. India—Orissa, Mussoorie—Kumaon. NR.

15 (14). ♂ above bright red ; vs. 2, 3 and 4 on F prominently black ; H all red except in 7 and veins not black (DSF may be dusky red with vs. on H black). ♀ coppery brown, with fuscous border as in ♂. Lobe red. Unh tornal spot in 2 prominent, orange crowned.

jarbas, F. (35–41). The Common Red Flash. Sikkim—Burma. C.

16a (8b). Unh discal band straight to v2 or at least to v3, sometimes even convex to termen, further from termen at upper than at lower end. ♂ brand dark brown, inconspicuous, behind origin v7 , tuft pale brown, often inconspicuous or absent in Nos. 16 and 17, always absent in No. 18. Tornal spots unh not prominent, spot in 2 always orange crowned.

16b (18). Above blue.

16 (17). ♂ above dark purple blue, shot brilliant deep blue, broad border on F. ♀ paler, steely blue above. Below rather pale ochreous brown, sometimes purple glossed, discal bands prominently dark brown, obscurely white edged outwardly.

buxaria, DeN. (38-42). The Shot Flash. Sikkim—Assam. R.

17 (16). ♂ above not shot blue. Very variable above and below. ♂ above dark steely blue to purple, border broad on F and often with an orange discal patch ; ♀ paler. Below very pale brown to dark ochreous brown, with or without a purple or rosy gloss ; discal band narrow ferruginous or dark brown, outwardly obscurely white edged.

α. Generally paler and smaller.

nissa nissa, Kollar. (34–38). The Common Flash. Kashmir—Sikkim. C.

β. Generally larger and brighter.

nissa rectivitta, M. (36-40). Sikkim—Assam. C.

v. rosacea, DeN. Below rosy. R.

γ. Always with a large orange spot upf ; steely blue above.

nissa nissoides, Swin. N. Burma—Shan States. C.

18 (16b). ♂ above dark brown, obscurely purple glossed with large central red areas F and H of variable extent and more extensive in the ♀ ; on H red area crossed by black veins ; lobe red. Below rather pale brown, double faint bars end cells ; discal band broad on F, narrow on H, slightly darker than ground, prominently white edged outwardly, on F slightly broken in.

micans selira, M. (32–34). The Red Himalayan Flash. Chitral—Kumaon. C.

H.90. Sinthusa.—The Sparks. (Plate 29.)

Below markings very much as in *Rapala*, bars end cells and discal band.

1 (2a). Below white, markings yellow centred and black edged ; discal band catenulated, broken usually at v4 F and H ; unh dark bar mid cell and another in 7 above it ; tornal spots prominent, orange obscure, metallic scales in 1. ♂ above greyish white, base F suffused dark brown and border very broad. ♀ as ♂ but pale area much more extensive. Lobe ochreous. ♂ unf no tuft, but with an oval orange patch of modified scales along v1.

virgo. El. (32–36). The Pale Spark. Sikkim—Manipur. VR.

♀ *v. confusa, Tyt.* The greyish white colour replaced by shining light blue. VR.

2a (1). Below not usually white and markings not yellow centred. ♂ unf with a tuft. Lobe above black centred with orange and metallic scales. ♂ above very deep blue, shot rich blue, border F broad ; H rich shining purple blue ; black portions of wing with a bronzy gloss. ♀ brown, often with a pale discal patch F and pale tornal area H.

2 (3). Below pale grey, no ferruginous tinge, markings broad, dark grey, white edged both sides ; F discal band irregular, broken at v4 ; on H broken at 2, 4 and 6 ; cell bars nearly coalesce with the discal bands ; H black spot mid cell and a larger one above it in 7. ♂ uph blue colour extends from v1 to v6 and through lower half of cell.

α. Below markings comparatively narrow, catenulated, marginal markings obscure. ♀ dark brown, may be slightly paler on disc F and before margin H and there may be some obscure bluish white patches in 1–4 H.

chandrana chandrana, M. (28–32). The Broad Spark. Kangra—Kumaon. R.

β. Below markings broader ; in WSF marginal markings prominent : DSF sometimes nearly white below. Typical ♀ as in α.

**chandrana grotei, M.* Sikkim—Burma. NR.

♀ *v. albidus, Evans.* Upf with a sharply defined or diffused yellowish white discal patch ; uph from as in typical form to almost entirely bluish white.

♀ *v. rubidus, Evans.* Upf with a more or less distinct red discal patch.

3 (2). Below bars and cells and discal band very narrow, nearly linear, ferruginous, outwardly white edged ; on F discal band continuous, unbroken : on H broken at v2 and 4. ♀ as in No. 2 α above.

α. ♂ uph blue colour confined to margin in 1, 2 and 3, extending to end cell in 3 and 4. Below pale grey with a ferruginous tinge ; in ♀ apex F pale ferruginous.

nasaka pallidior, Fruh. (28–32). The Narrow Spark. Kangra—Kumaon. R.

β. ♂ uph blue in 1–4 from margin to mid cell and along margin to 6. Below darker, markings more prominent. Unf termen ferruginous.

nasaka amba, Kirby. Sikkim—Burma. R.

H.91. Bindahara.—The Planes. (Plate 29.)

♂ above velvet black ; above tail H as well as tail and lobe pale ochreous. ♀ dark brown ; tornal area, lobe and tail white, veins black, prominent marginal spot in 2. Below ♂ ochreous ; F outer half and H apex dark brown ; ♀ white ; F broad dark brown band through mid cell and a broad discal band, broken out at v4 ; H 4 basal spots, double spot end cell and a much broken discal band consisting of 2 parallel lines, the interval between in the ♂ and sometimes in the ♀ being filled in dark brown in 6 and 7 ; black tornal spots in 1 and 2 crowned metallic scales and by the submarginal dark line.

α. ♂ uph margin brilliant purple blue in 3–5, followed by green in 2. Below ♂ pale ochreous : dark bands very prominent in ♀.

**phocides moorei, Fruh.* (38–42). The Plane. Ceylon, S. India. R.

β. ♂ uph uniform dark brown. Below darker ochreous.

phocides phocides, F. (36–40). Sikkim—Burma. Andamans. R.

γ. As last, but below paler and all markings tend to complete obsolescence. ♀ below markings pale ochreous.

phocides areca, Fd. (36–40). Nicobars. R.

H.92. Araotes.—The Witch. (Plate 29.)

♂ upf black, basal half shot brilliant blue ; uph brilliant deep blue, except for dark brown costa, ♀ dark brown, disc F obscurely reddish ; H tornal

H.92. Araotes.—(*contd.*)

area bluish white, veins black. Below white ; F basal ¼ and apical ½ ochreous, black edged ; H base and disc with irregular black markings, apex ochreous ; tornal marking prominent, crowned metallic scales.

**lapithis, M.* (28–32). The Witch. Sikkim—Burma. R.

H.93. Sithon.—The Plush. (Plate 29.)

♂ above brilliant deep shining blue, border 2mm. to 3 at apex ; H terminal ⅓ blue, rest black. ♀ dark brown, reddish on F ; tornal area H bluish white and veins black. Below white outer ½ F and outer ⅓ H dark chocolate brown in ♂, bright ochreous in ♀ ; F dark area divided by a white discal line, beyond which the apex is paler ; H apex and upper part termen paler, black discal line in 1a and 1 ; tornal area narrowly black, outwardly white edged and crowned metallic green scales in 1 and 2, a second metallic green line in 1 and a terminal line in 1a.

**nedymond ismarus, Fruh.* 30–34. The Plush. Dawnas—S. Burma. NR.

H.94. Liphyra.—The Moth Butterfly. (Plate 27.)

Above brown to rich yellow with an irregular, broad black border ; upf a large black spot at end cell, extending into bases 2 and 3 ; uph a black spot end cell and large spots at bases of 2 and 3. Below dull yellow, marked rather as above.

**brassolis, Wd.* (86–92). The Moth Butterfly, Sikkim—Burma. VR.

NOTE.—(1) From an examination of the types, I am satisfied that *Poritia geta* (H. 2.4) is a race of *pleurata* ; typical *pleurata* is hardly separable from *regia*. Fruhstorfer in Arch. Nat. 1917, puts *geta* as *hewitsoni*, which is incorrect. Mr. G. E. R. Cooper obtained 2 examples of a *Simiskina* in Mergui, which differed from examples of *pediada* I had from Tavoy : I find that his specimens correspond exactly with Hewitson's type of *pediada* and that my Tavoy insect is a race of *pasira, Moulton*, from Borneo and I have called it *dohertyi* : it differs from *pasira* in being browner below. (H3. 2 and 4). Fruhstorfer follows Swinhœ in keeping *potina* distinct from *phalia* ; from an examination of the types I am certain that they are conspecific, though I cannot say what species Swinhœ's blue ♀ from Labuan pertains to. (H 3–5). To Mr. Cooper belongs the credit of establishing *elsiei* (H. 3. 7).

(2) The Genus *Nacaduba* (H. 30) has given a great deal of trouble. I have examined the types of *pavana*, *hermus*, *atrata*, *prominens* and *akaba*, while Mr. Riley had kindly dissected a number of specimens on my behalf and Mr. Ormiston has studied most carefully the members of the genus occurring in Ceylon. The results are given in the key and, though finality has by no means been reached, some progress has, I think, been made. What has generally been accepted as *pavana* by all recent authors including Fruhstorfer in Leiden Zool. Med. 1915, covers 3 species, two of which are without doubt *pavana* and *hermus* ; the 3rd I have called *vajuva, Fruh*, but cannot say if this name is correct. The names in the *atrata* group are, I think, correct : it will be noted that Mr. Ormiston has established the existence of a hitherto unsuspected species in Ceylon. Mr. Ormiston has also established the identity of *Nacaduba noreia, Fd.* and its relationship to *hampsoni* seems clear : Major C. H. Stockley obtained a specimen of *noreia* in Burma recently.

(3). Fruhstorfer in Arch. Nat. 1915, produced a revision of the genus *Jamides* (late *Lampides*) (H. 31). He gives *pura* as a synonym of *celeno*, from which it is perfectly distinct. He places *coruscans* and *singalensis*, as races of *suidas, Fd.*, and *kondulana* but both are to my mind very distinct species, which cannot be linked up with Malayan species. He also places *pseudelpis* as a race of *kondulana* : the type of *kondulana* is in Vienna and I have not seen it, nor I believe had Fruhstorfer : for the present I prefer to treat it as a race of *elpis* and to treat *pseudelpis* as a separate species.

(4) *Curetis* (H. 44) has been treated in accordance with Chapman's revision in N.Z. 1915. Personally I am not as yet able to agree to the conclusions therein arrived at. I have not seen a white ♀ of the thetis group from Burma, nor a yellow ♀ of the *bulis* group from N. of the Karen Hills. More material is still wanted to clear up this genus.

(5) As may have been expected the genus *Amblypodia* (late *Arhopala*) (H. 49) has given a lot of trouble and here again Mr. Riley has helped me with dissections, thereby clearing up the *camdeo* group. I have sunk Bethune

H.94. Liphyra.—(*contd.*)

Baker's *nicevillei* and *oberthuri* to *silhetensis* and *alaconia*, respectively. I find that *atrax=aida, DeN*, and *mindanensis, BB.* : the type of *alea, Hew* is lost, but Mr. Riley and I are satisfied that it is synonymous with *selta, Hew. constanceæ, DeN*, appears to be a race of the very variable *alea* from the Andamans and Mr. Ollenbach has presented a pair of this variety to the B. M. I cannot see that *perissa* and *tounguva* can be maintained as species distinct from *agelastus* and *asopia*.

(6) *Everes parrhasius rileyi, Godfrey*, is I think a synonym of *assamica, Tytler*. (H17.3). *Strymon saitua, Tytler*, of *mackwoodi* (H 39.2) and *Tajuria tyro, DeN* of *isæus, Hew.* (H. 63.13).

(7) The following are new names : *Amblypodia adatha regia* (H. 49.23). *Surendra todara karennia* (H. 50.4). *Spindasis vulcanus tavoyana* (H. 56.2). *Pratapa icetas extensa* and *mishmia* (H. 59.5). *Tajuria yajna ellisi* (H. 63.4) *Hypolycaena thecloides nicobarica* (H. 83.2). *Rapala suffusa rubicunda* (H. 88.6). *chandrana grotei* ♀ vars *albidus* and *rubidus* (H. 90.2).

(8) The following are MS names : *Sinthusa virgo* ♀ v. *confusa* (H. 89.1) of Major-General H. C. Tytler. *Spindasis elwesi* (H. 56.12) of Mr. N.D. Riley.

(9) The following are new to the Indian Empire :—

(*a*) Obtained by Mr. G. E. R. Cooper in Mergui:—*Poritia philota* (H. 2,2). *Simiskina pediada* (H.3) : *pharyge* (H. 3.3). *Logania sriwa* (H. 7.1). *Lycaenopsis cossaea distanti* (H. 20.11 B). *Amblypodia agesilaus* (H. 49.15A): *amphimuta*. (H. 49.15B). *cooperi* (H. 49.38). *Drina maneia* (H. 55.2). *Purlisa gigantea* (H. 69).

(*b*) Obtained by Mr. F. Mackwood in Mergui : *Lycœnopsis haraldus ananga* (H. 20.1). *Amblypodia karennia* (H. 49.7). *Rapala pharitimus pheretimus* (H. 88.12).

(*c*) Obtained by Col. C. H. Haswell, R. E.:—*Polyommatus iolas* (H. 24 4).

(*d*) Obtained by Messrs. Ollenbach and Field, *Amblopala avidiena* (H.43B)

(*e*) Obtained by Major-Genl. H. C. Tytler :—*Lycæna astorica* (H. 23.8).

(*f*) Obtained by Mr. O. C. Ollenbach : *Azanus urios* (H. 32.3). *Callophrys chalybeia* (H. 38.3).

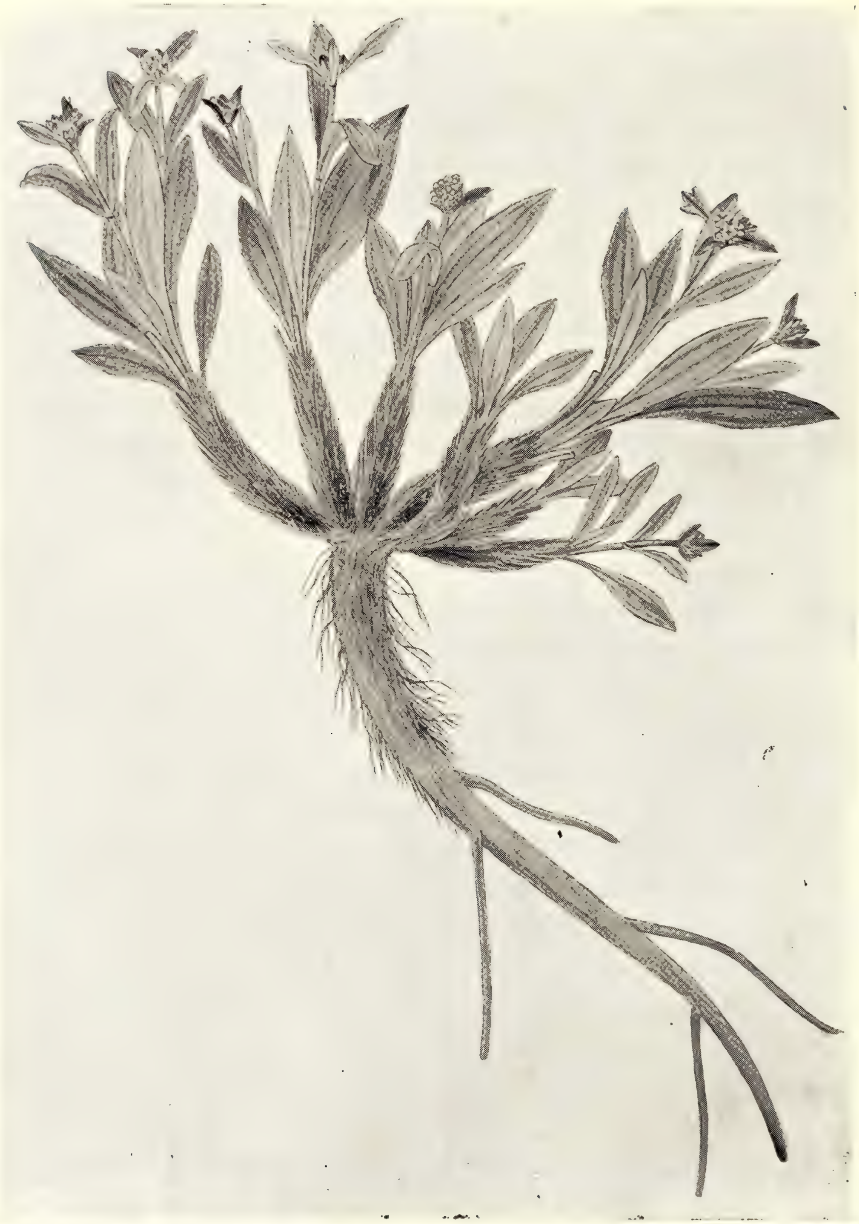
(*g*) Obtained by myself and from miscellaneous sources—*Lycœna pylaon indica* (H. 23.4). *Polyommatus poseidon poseidonides* (H. 24.3). *Jamides lugine purpura* (H. 31.10). *Heodes phœnicurus* (H. 35.5). *Amblypodia dispar* (H. 49.6). *ariana* (H. 49.19). *adatha regia* (H. 49.23). *pryeri* (H. 49.30). *paralea* (H. 49.37) : *corinda acestes* (H. 49.46).

(*h*) Obtained by Major F. M. Bailey :—*Thecla bieti irma* (H. 42.2)

(*i*) Capt. N. D. Riley has recently (N. Z. 1925) pointed out the differences between *acamas* and *epargyros* : he has transferred these two species, as well as *lilacinus*, from *Spindasis* (H. 56) to a new genus *Apharitis*, distinguished by having an ill-developed lobe and by the tail at v 2 being half as long as the tail at v 1, instead of equal to it.

(*j*) The genus *Thamala* (H. 78) requires more study : *miniata* is probably conspecific with *marciana, Hew* and there are certainly two races, perhaps two species flying in Burma.

(*To be continued*)



INDIAN SPIKENARD.

Nardostachys jatamansi. (After Royle.)

ON THE ANTIQUITY AND THE THERAPEUTIC USES OF THE INDIAN SPIKENARD

BY

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(*With a plate*)

Its Antiquity.—A very remote antiquity is assigned to the use of the spikenard as a valuable drug and as a perfume. Among the ancients, it long maintained its reputation as the principal aromatic ingredient of many precious ointments. Its use as a medicine in Asiatic countries extends back into the dim past. The medicinal virtues of *Jatamansi* were known to the Hindus long before the Christian era. The spikenard was highly esteemed by the Romans and Syrians for its fragrance and was much used by them in perfuming their baths. Frequent references to the spikenard and its use as a cosmetic are found in the Bible. It is strongly believed that the essential oil yielded by this plant formed an aromatic adjunct to the ointment of spikenard alluded to by St. John xii. 3.—'Then took Mary a pound of ointment of spikenard, very costly and anointed the feet of Jesus. . . . . and the house was filled with the odour of the ointment'; and by St. Mark xiv. 3.—'There came a woman having an alabaster box of ointment of spikenard very precious; and she broke the box, and poured it over his head.' The spikenard was in great demand at Jerusalem and at Rome, and was sold, according to Pliny, at 100 denarii [1] per pound. The word 'nard' occurs in the Song of Solomon. The plant is mentioned by Theophrastus [2] in his *History of Plants.* Dioscorides, the famous writer on *Materia Medica*, who flourished in the first century or about the beginning of the second century of the Christian era, describes three kinds of Nardin, viz., the first kind having two varieties, (*a*) Syrian and (*b*) Indian, also called Gangites, from the River Ganges which flows from the foot of the mountains where the plant grows, the second kind is called 'Celtic', and the third 'Mountain nard'. Pliny (A.D. 79) remarks that the leaf nard or spikenard held the first place in Rome among the aromatic ointments of his day; and he observes (xii. 26) 'Leaf nard varies in price according to the size; for that which is known by the name *hadrosphærum*, consisting of the larger leaves, sells at 40 denarii per pound. When the leaves are smaller, it is called *mesosphærum*, and is sold at 60. But that which is considered the most valuable of all, is known as *microsphærum*, and consists of the very smallest of the leaves, it sells at 75 denarii per pound. All these varieties of nard have an agreeable odour, but it is most powerful when fresh. If the nard is old when gathered that which is of a black colour is considered the best'.[1] It is said that the spikenard referred to in Mark[2] was valued at 300 denarii per pound (Pliny). Ptolemy (A.D. 151) describes the plant under the name of 'nardus' and Galen (A.D. 130-200) under the name of 'Nardostachys'. The plant is mentioned by Horace who remarks (II, vii, 89) that spikenard was one of the most treasured ingredients of the ointments and perfumes of the Roman Empire.

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[1] Denarius is a silver coin of ancient Rome, worth about $7\frac{3}{4}d.$ English, first coined 269 B.C.

[2] Circa 372-287 B.C.

Although the word 'nard' is mentioned by the early Greek writers, Theophrastus, Dioscorides and Galen, and among the Romans by Horace and Pliny, it is in reality a Persian word signifying a part of a vegetable. The Arabs have borrowed the word 'nard', but used it in the sense of a 'compound medicinal unguent'. The Arabic word 'Senbel' has long been substituted as a synonymous name. The word 'Sumbul' which signifies in Arabic vocabulary an ear or spike was always considered by Arabian authors as synonymous with the Nardos of Ptolemy and the Nardostachys or spikenard of Galen.

Under the name 'Sumbul' four separate articles are described (1) Sumbul-hindee, (2) Sumbul-roomee, called also Sumbul-ukletee and Narden-ukletee, evidently the Nardin of Dioscorides, said also to be called Sumbul-italioon, i. e., Nard which grows in Italy ; (3) Sumbul-jibullee or Mountain Nard and (4) Sumbul-farsee which is a bulbuous plant and probably a kind of hyacinth (Dr. Royle).

Sumbul-hindee is the plant with which we are concerned. The Persian lexicographers give the following synonyms:—*Arabic*, Sumbul-ool-teeb or fragrant nard ; *Greek*, Narden ; *Latin*, Nardoom ; *Hindee* ; Balchur and Jatamasee. The Mussulman physicians describe Jatamansi of the Hindus under the name of Sumbulu'l Hind and distinguish it from their Sumbul-i-Roomee or Ukletee (*Valeriana celtica*), the fragrant root of which is much used in Turkey and Egypt as a perfume. The author of *Makhzen-el-Adwiya* compares Jatamansi root to the tail of a Sable. The Sumbul of India is described by Mussalmans as a 'herb without flower or fruit' (perhaps only the drug is referred to) like the tail of an ermine, or of a small weasel, but not quite so thick and about the length of a finger. It is darkish inclining to yellow, and very fragrant; it is brought from Hindusthan and its medicinal virtue lasts 3 years. (Sir We Jones). The spikenard is referred to as a valuable drug under the names Mamsi and Nalada in the *Bower Manuscript* (8th century).

Identification.—Much difficulty was experienced in botanically determining the spikenard of the ancients. On account of the inaccessible habitats of the plant and the consequeut difficulty in procuring living specimens and also of the philological confusion in the terms nard and spikenard, it long eluded the researches of the investigators. It was through the laborious researches of Sir William Jones that the spikenard was correctly identified with 'Jatamansi' of the Hindus. A distinction is usually drawn between the nard and the spikenard. Nard has been generally supposed to be a grass. Linnaeus described nard as a graminaceous plant and a species of *Andropogon.* For a long time spikenard was erroneously identified with *Andropogon jwarancusha.* In many botanical works of Europe, the spikenard was long marked as 'unknown.' Although Linnaeus described 'nard' as a kind of grass he expressed his doubt as to the proper systematic position of the true spikenard. Kœnig described Indian nard as a kind of grass, but he was not certain as to what the Greek writers understood by the nard of India. *Andropogon schoenanthus*, a sweet-scented grass, a native in the West Punjab, Beluchisthan, Central India, Arabia and Persia, was once supposed to be the source of Indian spikenard. The spikenard was even mistaken for its highly fragrant odour for *Cetaca* or *Pandanus* which 'is an incomparable plant, and cultivated for its odour, which it breathes so richly, that one or two spikes, in a situation rather humid, would be sufficient to diffuse an odoriferous air for a long time through a spacious apartment ; so that the natives in general are not solicitous about the living plants but purchase the spike at a great price '. It was sometimes confounded with a species of *Cyperus* or with a kind of *Pimenta* (a species of *Myrtle*). But the elaborate researches of Sir William Jones embodied in his classical paper on the 'Spikenard of the Ancients' published in the *Asiatic Society's Researches* dispelled all doubts and settled all disputes as to the identification of the Indian spikenard with Jatamansi of the Hindus. It has been proved beyond doubt that the spikenard and Jatamansi are one and the same plant. The word 'spikenard' owes its origin to the resemblance of the drug to a spike, when it is dried and not to the configuration of its flowers. The fibrous part above the root looks like a spike and was long mistaken for it. The stachys or spike which is the characteristic of the inflorescence of *N.o. graminæ* perhaps gave rise to this wrong notion. 'The dried specimens which look like the tails of ermines, rise from the ground, resembling ears of green wheat both in form and colour, a fact which perfectly accounts for the names *Stachys*, *Spica*, *Sumbul*, and *Kushah*, which Greeks, Romans, Arabs and Persians have given to the drug, though it is not properly a spike.' (Sir W. Jones.)

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[1] Schoff, *Periplus of the Erythrean Sea.*

[2] St. Mark xiv. 3.

Distribution.—The plant which is the source of Jatamansi or Indian spikenard is a native of the Alpine Himalaya and usually grows at great elevations (11,000-15,000 feet). In the parts of the Himalayas visited by Dr. Royle, it was found on such lofty mountains as Kedarkanta and Shalma which are elevated at 9,000 feet and which remain covered with snow for nearly six months. Ptolemy fixes its native soil in the most remote and hilly parts of India near Nepal, Morang and Bhutan (Sir W. Jones). In the mountainous region, west of the Indus near Nysa, Curtius Rufus, at the time of Alexander's invasion of India (about 326 B.C.) saw the crags frequently overhung with thickets of laurels and spikenard. Nysa was perhaps the city which Ptolemy calls Nagara or Dionysopolis or Nagarahara of Sanskrit, an ancient capital, the ruins of which have been traced at a distance of four or five miles west from Jellalabad. The place was also called Udyanpura or the City of

Gardens. The plant was also found at Rhadamarkotta, identified by Saint Martin with Rangamati, an ancient capital situated on the western bank of the lower Brahmaputra (Ptolemy—about the middle of second century A.D.). Yule mentions Rangamati as Rangamritica. Aristoboulos says that the Gadrosian desert (on the Beluchistan coast) yields an abundance of sweet-scented roots of nard which the Phœnicians collected ; and much of it was trodden down by the army of Alexander on its homeward march and the sweet perfume thus crushed out of it was from its great abundance diffused far and wide over the country. It is now believed that the nard alluded to above is not the true spikenard but a kind of odoriferous grass (probably a species of *Andropogon*). It is interesting to find the mention of spikenard among the few aromatic substances described by Theophrastus as being brought from India. Cosmas Indicopleustes mentions that spikenard is found at Sindu which is on the Indian frontier (sixth century A.D.). Strabo (A.D. 21) mentions that India, like Arabia and Ethiopia, produces cinnamon, spikenard and other aromatics. Marco Polo, a Venetian, in the thirteenth century describes the spikenard as the produce of 'Bengala.'[1] Garcia d'Orta, for many years, during the sixteenth century, Physician to the Viceroy's Court at Goa, speaks of the spikenard as procured from Mandu and Chitor in Central India. It seems likely that he confused Andropogon with Nardostachys, as *Andropogon Schœnanthus* (an odoriferous grass) is found to grow luxuriantly at those localities. A similar confusion with regard to the native soil of this Himalayan plant is made by Linschoten in the account of his voyage to the East Indies.

Spikenard as a Commercial Commodity.—India, in the remotest antiquity, was highly famed for the variety and richness of its peculiar products which were well known to and highly esteemed by all the most ancient and civilized nations. The valuable products of India offered sufficient inducement to distant nations to establish commercial intercourse with India and to visit India or its shores. So varied and so precious were the Indian products that, in ancient times, India became the cynosure of the eyes of all nations and became the ultimate object of those long and arduous journeys and circuitous and adventurous voyages of antiquity. The earliest historical and commercial records incontestably prove the antiquity of the commerce of Indian products. Indian aromatics and spices, pearls and precious stones, cotton and wool formed early articles of export in ancient days. Egypt was the seat of the highest civilization in the remotest antiquity and was much frequented by the Greeks who derived their arts and sciences in the first instance from Egypt. There was extensive commercial intercourse between ancient Egypt and India and the trade between India and Egypt was in the hands of the Arabians and Phœnicians. It is said that more than seventeen centuries prior to the Christian era the Ishmaelites from Gilead used to carry the spices and aromatics of India to Egypt for a market.[1] The Indian products in ancient times reached Caubul, Persia and Babylon by the north and up the Euphrates or across Arabia to Syria, Palestine and Egypt. Ancient historical records show that the products of the East reached the West by the Red Sea, Arabia and Egypt and by the Euphrates through Palmyra to Syria.

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[1] W. Marsden, *Travels of Marco Polo*, Book II, ch. xlv.

The spikenard was a peculiar Indian product known to ancient commerce. It was highly praised on account of its sweet fragrance and medicinal virtues and was in great demand in Egypt, Arabia, Rome and Jerusalem. It was sold by the Indians to the Persians and Arabs from whom the Syrians and Romans used to receive it. It was a very costly article and was extremely dear at Jerusalem and Rome and was sold, according to Pliny, at 100 denarii per pound at Rome. The spikenard referred to by St. Mark in the Bible was valued at more than 300 denarii per pound (Pliny). (A denarius = 7¾*d.*). At the time of Periplus (A.D. 40–70) spikenard was shipped in considerable quantity to Nelcynda, where the Romans found it. Nelcynda was the port probably in the backwaters or thoroughfares behind Cochin, very near the modern Kottayam. Among the articles of trade mentioned in the *Periplus*, we find spikenard as a vegetable product exported from India through Scythia and through Poclais. We find the mention of spikenard as an aromatic product among the articles subject to duty at Alexandria.[2]

Cosmas Indicopleustes[3] tells of Ceylon and its trade in the sixth century A.D. In his account of the trade of Ceylon 'the great island of the ocean, situated in the Indian Sea; which is called Sielediba' he mentions that Spikenard is found at Sindu which is 'the beginning of India; for the River Indus, which empties into the Persian Gulf, separates Persia from India' and is one of the best-known market-towns of India. Marco Polo[4] in the thirteenth century describes spikenard as the produce of Bengala, to purchase which the merchants from various parts of India resort thither. Dr. Royle[5] remarks that the roots of Jatamansi, no doubt the spikenard of the ancients are brought down in large quantities from the Himalayas to the plains, when they are distributed over every part of India. Atkinson[6] states that its roots are sent down to the plains to the extent of about twenty maunds a year. The article is hardly in demand in these days and practically there is no export out of India. The bazaar price of Jatamansi, which was once a very costly article, has now come down to a few annas per pound.

Exact Botanical Determination—It has been definitely ascertained that the product 'Jatamansi' or the Indian spikenard is derived from the plant, *Nardostachys jatamansi* DC. Sufficient proofs have been adduced by Sir W. Jones in his valuable and elaborate researches on the Indian spikenard to establish the fact that the spikenard of the ancients, the nardus of Ptolemy, the Indian sumbul of Persians and Arabs, the Jatamansi of the Hindus are one and the same plant which is synonymous with *Nardostachys jatamansi* of modern botanists. Sir W. Jones and Dr. Roxburgh named the plant *Valeriana jatamansi* but the plant figured by them (as shown in the plates accompanying their papers) represents *V. wallichii* DC, a plant of the same natural order but found at a much lower attitude on the Himalaya. Although Sir William was mainly instrumental in exactly determining the plant, he failed to procure a specimen of true *Jatamansi*. 'It is most probable that the wrong plant was purposely sent to Sir W. Jones, in place of the true *Jatamansi*, which appears to have been so highly valued by the Bhutan authorities that strict orders had been given forbidding the exportation of living plants from that country. Dr. Wallich and Dr. Royle independently detected the imposture, and the true plant was sent home and described by Don in his *Prodromus Flor. Nep.* under the name of *Patrinia jatamansi*. It was afterwards removed by DeCandolle to the genus *Nardostachys*.' (J. F. Duthie).

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[1] Remark of Dr. Vincent in Prl. Disq. to Transl. of Arrian's *Periplus of the Erythrean Sea*.

[2] Rescript concerning Eastern Trade in the digest of the Roman Law.

[3] *Christian Topography*, Book XI.

[4] *Travels of Marco Polo*, Book II, ch. xlv.

[5] Dr. Royle, *Illustrations of the Botany*, etc.

[6] Atkinson, *Gazetteer of the Himalayan Districts*.

Sir William Jones and Dr. Roxburgh obtained specimens of *Valeriana wallichii*, the plant which was wrongly identified by them with *V. jatamansi* and was supposed to be the source of Jatamansi root of commerce. This error, however, was subsequently rectified by Dr. Wallich and Dr. Royle, and *Nardostachys jatamansi*, DC. is now authoritatively recognized as the source of the Indian spikenard or Jatamansi. In this connection Sir J. D. Hooker remarks 'The name *V. jatamansi* is hence to be suppressed.' [1]

Spikenard in Botany of to-day.—The plant belongs to *Valerianeæ* which is a small natural order consisting of only 300 species and is distributed over all cool and temperate regions except South Africa and Australia. This order is found at different elevations (11,000–17,000 feet) on the Himalayas, proceeding along Caucasus to the Himalayas. It is not seen in the plains of India, but one species, *V. villosa* is found to occur at Dehra Dun (Dr. Royle). *V. celtica* occurs in the mountains of Austria.

Description of the plant.

Nardostachys jatamansi, DC.

Habitat.—Alpine Himalaya (altitudes 11,000–15,000 feet) extending eastwards from Garhwal, and ascending to 17,000 feet in Sikkim. Occurs in Nepal, Bhutan and Sikkim. It is found to occur at Râlam and Milam at altitudes 12,000–13,500 feet, and also in China.[2]

Syn.—Patrinia jatamansi, Don ; *Valeriana jatamansi*, Wall.

Vern.—Hind. Jatamasi, bal-chhar ; Beng. Jatamansi ; Bomb. Sumbul ; Arab—Sumbulu'l-hind ; Pers. Sumbuluttib ; Sans, Jatamansi. It is sometimes called Bhutakeshi (demon's hair). In the Deccan it is often called Billi-lotan, cats being supposed to be fond of the smell of the root of this plant.[3] In Sanskrit it is known under various names—'*Tapasvini, Jatamansi, Jatila, lomasha, mishi.*'—*Amarkosh.*

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[1] Sir J. D. Hooker, *Flora of British India*, vol. iii.

[2] Strachey, *Catalogue of Kumaon Plants.* (Based on the collections by Strachey and Winterbottom within province of Kumaon and in adjoining parts of Garhwal and Tibet during 1846–49).

[3] Valerian oil is frequently used by the Society's Collectors for trapping the smaller *Felidæ*.—*Eds.*

It is an erect perennial herb. Rootstock—long, woody, covered with reddish-brown fibres, the remains of the petioles of withered leaves. Radical leaves, longitudinally nerved, slightly pubescent, narrowed into the petiole; cauline, one or two pairs sessile, oblong or subovate. Flowers-bracts, oblong, usually pubescent; calyx-limb, 5-lobed; Corolla-tubular, somewhat hairy within, lobes 5, spreading; the corolla tube enclosing 4 stamens; ovary—inferior, 3-celled, 1-ovuled, two of the compartments of the ovary being empty; style-liner; Fruit-obovate, 3-celled, 1-seeded, the two barren cells smaller than the fertile, covered with white hairs, crowned by the ovate, acute often dentate calyx-teeth.

Parts used—(1) Rootstock and (2) Oil.

The drug.—The drug Jatamansi which is manifestly the spikenard of the European druggists appears in the form resembling the tail of a sable. It consists of a short portion of the rootstock about the size of a man's little finger, of a dark grey colour, clothed by fine yellowish-brown fibres cohering in a bundle. The fibres are the remains of the withered petioles of the radical leaves and are matted together, the whole presenting the appearance of a matted lock of hair, the Sanskrit name *Jatamansi* having a reference to this resemblance. 'The radical leaves, rising from the ground and enfolding the young stem, are plucked up with a part of the root, and being dried in the sun or by an artificial heat, are sold as a drug which from its appearance has been called spikenard.' (Sir W. Jones). Sometimes the entire plant is collected before the radical leaves have unfolded themselves from the base of the stem and is sold as a drug.

Adulteration.—Pliny mentions a kind of nard growing in the vicinity of the Ganges, which is condemned as utterly bad. It bears the name of Ozænitis and emits a fœtid smell. It is now considered as a variety of Andropogon. Sometimes 'the nard is adulterated with a plant called pseudo-nard which grows everywhere and has a leaf unusually thick and broad and a sickly colour inclining to white. It is further adulterated by being mixed with its own root to give it additional weight—a purpose for which gum and the litharge of silver are also employed, and sometimes antimony and cypirus or at least cypirus bark. Its purity is tested by its lightness, the redness of its colour, the sweetness of its smell and more particularly the taste, which parches the mouth, while at the same time the flavour is most delicious.' (Pliny).[1]

The odour of the drug is heavy and peculiar, the taste bitter and aromatic. It is remarkable for the presence of an essential oil.

Chemical composition:—

Oil.—The oil of Spikenard is obtained from *N. jatamansi.* Kemp (1884) distilled 56 lbs. of Jatamansi and obtained three fluid ounces of the oil having an optical rotation of—19·5 in 100 mm. and the sp. gr. 0·9748 at 82°F. 100 lbs. of the root, subjected to distillation with water by Messrs. Kemp and Co. (1890) yielded 15 oz. (fifteen ounces) oil and a faintly acid distillate. The oil is pale yellow in colour; and 'a fine violet or bluish colour is produced as with oil of Valerian, by mixing a drop or two of the oil with about twenty drops of carbon bisulphide and a drop of strong nitric acid. With H_2SO_4 the oil gives a reddish brown colouration. On boiling the oil acquires a darker hue and a greenish fluorescence' (Dymock quoting J. G. Prebble). In the East it is of much value as a perfume, but in western countries its use is practically replaced by that of oil of Valerian.

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[1] J. W. M'Crindle, *Ancient India.*

Oil of Valerian—is usually obtained from the root of *Valeriana officinalis*, B. P. by distillation. For this purpose the Dutch and Thuringian herb was mostly used in Europe ; but nowadays the oil is mainly extracted from the Japanese root (the variety *agustifolia*). The Japanese root yields from 6 to 7 per cent of oil, whereas the European root yields only 1 per cent. The oils in both cases are quite similar and show the same properties. The sp. gr. of the oil from European variety is ·930 to ·960 and the oil from the Japanese variety known as Kesso oil, has a sp. gr. ·985 to ·995. *Valeriana celtica*, growing in the Swiss Alps and the Tyrol yields an essential oil of sp. gr. ·960 to ·970, the yield being about 1 per cent. The oil is mainly used for medicinal purposes and to a certain extent in soap perfumery. (E. J. Parry).

Valerianic acid :—Free Valerianic acid does not occur in the fresh root but is generated from the volatile oil on exposure to the air. It is an oxidation product. It is an oily liquid, of a characteristic sweet taste used in preparing various valerianates, as valerianates of iron, zinc, ammonium and quinine. (Khory and Katrak).

Dye :—' Mc. Cann states that the rootstock of this plant is used in Lohardaga (Bengal), as an auxiliary in dyeing along with Kamalagundi (*Mallotus phillippinensis*). (J. F. Duthie).

Therapeutics :—The medicinal virtues of the spikenard or Jatamansi have long been known and appreciated in Arabia, Persia and India. It is generally agreed that the nations of the East were the first to use the drug medicinally. It has long been used and highly valued in Indian medicine being mentioned by Susruta and in the *Bhavprakash* and other ancient Sanskrit works on Medicine. Susruta prescribes the drug as a remedy for epilepsy. It is also referred to in Charaka, the oldest Sanskrit work on Hindu Medicine and probably almost contemporary with Susruta. There it is stated that the clothings of a new-born baby are to be disinfected by fumigating them with Jatamansi and other aromatic substances.[1] In *Sanskrit Raj Nighantu* it is described as cold, bitter, aromatic and as a remedy for morbid heat and biliousness.

> ' Suravi Kasháyá Katu Sitalá Kafahrit
> Bhutaghni Dáhaghni Pittaghni Cha.'[2]

It is also regarded as a remedy for leprosy and erysipelas.

> ' Tikta Kasháyá medhyá Kántidá Balyá
> Svádurhimá tridoshá raktadáha *bisharpa*
> *Kushthaghni* Cha.' [3]

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[1] *Charaka*, Swărirsthan, chap. 8 (55).

[2] *Raj Nighantu*.

[3] *Bhaba Prakash*.

If it is used to anoint the body, it soothes the system and bring down the temperature of the body in fever, thus acting as febrifuge.

'Tadanoolepanam Jwaraghnam rookshatághnam Cha'.[1]

It is generally used by Hindu physicians as a nervine tonic and stimulant. In India it is much employed as an aromatic ingredient in the preparation of medicinal oils and *ghritas.* It is regarded as one of the most important medicines in the Hindu Pharmacopœia.

Numerous references to the medicinal use of the spikenard are seen in the Bower Manuscript[2] where it is described under the names of Mámsi and Nalada. As is usual in Hindu medicine, it is rarely given alone, but enters as a chief ingredient in a number of complex prescriptions, each of which is supposed to possess some special virtue. Mámsi is used as an ingredient in the preparation of medicines for the diseases of the eyes and for ailments caused by the derangement of bile.[3] It is said to be useful as an antidote for poison, especially to remove the effects of spider's poison.[4] It is employed in making the Haridrá Powder of the Asvins which is regarded as a cure of indigestion, retention of discharges, costiveness, etc.[5] The same drug described as Nalada is used in the preparation of Asvagandhá Oil, along with many other medicines as a remedy of apathy, dumbness, lameness, stammering, paraplegia, etc.[6] It forms an ingredient in the formula for the cure of hemorrhage.[7] It is prescribed, with other medicines in the diseases of the mouth and in the most excruciating earache.[8] It is employed as the chief ingredient in the preparation of a valuable medicinal oil, 'The Siddhártha Oil, devised by Narayana.'[9] This oil is regarded as a remedy for the lame, in short, for those suffering from rheumatic diseases and distorted bones. It is truly called *Siddhártha* or 'efficacious' as it is recommended as a cure of almost all the ills that flesh is heir to, and is said to promote the life of man.

Arab and Persian physicians consider the drug as very useful in various disorders of the digestive and respiratory organs and recommend it as a nervine tonic in hysteria. It is popularly believed to promote the growth and blackness of hair. It is said to be useful as an expectorant, and as deobstruent, stimulant and diuretic.

Ainslie observes that in Lower India the Vytians prepare from this drug an aromatic and soothing liniment which is applied to the head. Jatamansi is also used by them internally as a purifier of the blood. O'Shaughnassy finds Jatamansi, from his experience, a perfect representative of Valerian and recommends it as a good substitute.[1] The drug has acquired a considerable reputation in European medicine too.

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[1] *Rajballav.*

[2] Bower Manuscript (translated by Hoernle) is named after its discoverer, Major-General H. Bower, C.B. It 'fell into the hands of that officer, early in the year 1890, in Kuchar where he had gone on a confidential mission from the Government of India'. Kuchar is in Khotan in Eastern Turkistan on the Caravan route to China. The Manuscript in question is a very ancient *Puthi.*

[3] Bower Manuscript, vol. i, 91, 107.

[4] *Ibid.*, vol. i, 97.

[5] *Ibid.*, vol. ii, 96.

[6] *Ibid.*, vol. ii, 345, 354.

[7] *Ibid.*, vol. ii, 419.

[8] *Ibid.*, vol. ii, 535, 1073 *a.*

[9] *Ibid.*, vol iii, 40.

Valerian is used as a stimulant and antispasmodic for the treatment of hysteria, epilepsy, St. Vitus' dance and other nervous affections. In moderate doses, if continued for some time, it may improve the appetite and move the bowels. When taken in very large doses (2 drachms at a single dose) it acts as a powerful irritant of the gastro-intestinal tract causing eructations, vomiting, colic and diarrhoea, attended with a sense of heaviness and heat in the abdomen, and perspiration or frequent passage of urine. In smaller doses its action is chiefly confined to the nervous system producing exhilaration of spirits, and rendering the mind tranquil and active. Sometimes it produces heaviness and pain in the head attended with a sense of confusion. If long continued, it may lead to melancholia. In full doses it stimulates the heart and often promotes sexual powers.[2] Although Valerian is often employed in the treatment of hysteria it is not regarded as a cure for the disease but acts as a most valuable palliative in hysteria, in its various manifestations, its pain and its headache. It is especially useful in the case of weakly females of excitable temperament. In all convulsive affections, and in mild cases of mental derangement or cerebral congestion and cerebral anæmia, it is found to be beneficial as an efficient palliative. In all these cases Valerian acts like asafœtida or musk. Ammoniated tincture of Valerian is often successfully administered in nervous headache. In cases of flatulence, accompanied with palpitation of the heart, Valerianate of ammonium is sometimes prescribed along with a carminative tincture. It is efficient in relieving infantile colic. (Dymock).

It is sometimes found to be beneficial as a vermifuge, and is recommended to be administered by enema as a remedy for ascarides of the rectum. It is found to be beneficial in cases of dysmenorrhœa and diabetes insipidus. 'Bouchard claims that when the urine contains an excess of urea (azoturia) or of sugar (glycosuria), Valerian diminishes the amount of solids discharged and thus acts as a conservator of tissue and of force (Stille and Maisch).'[3] It is sometimes prescribed in mild forms of delirium tremens following any injury or surgical operation.

Valerianic acid.—'Given to rabbits in doses of from one to three drachms, Valerianic acid renders the heart's action more rapid, but feebler, the respiration is hurried at first and then slower; and death usually takes place in three or four hours, preceded by prostration and convulsions. If death occurs speedily, the gastric mucous membrane is pale but if delayed it may be congested; the kidneys are apt to be congested and the urine bloody. . . . Valerianic acid, applied to the human skin, produces a white spot, followed by irritation and redness, and upon the tongue it may cause the epithelium to exfoliate.'[4]

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[1] *Bengal Disp.*, p. 404.

[2] Khory and Katrak, *Materia Medica.*

[3] *Pharmacographia Indica.*

[4] *Ibid.*

NEW THYSANOPTERA FROM SOUTH INDIA.

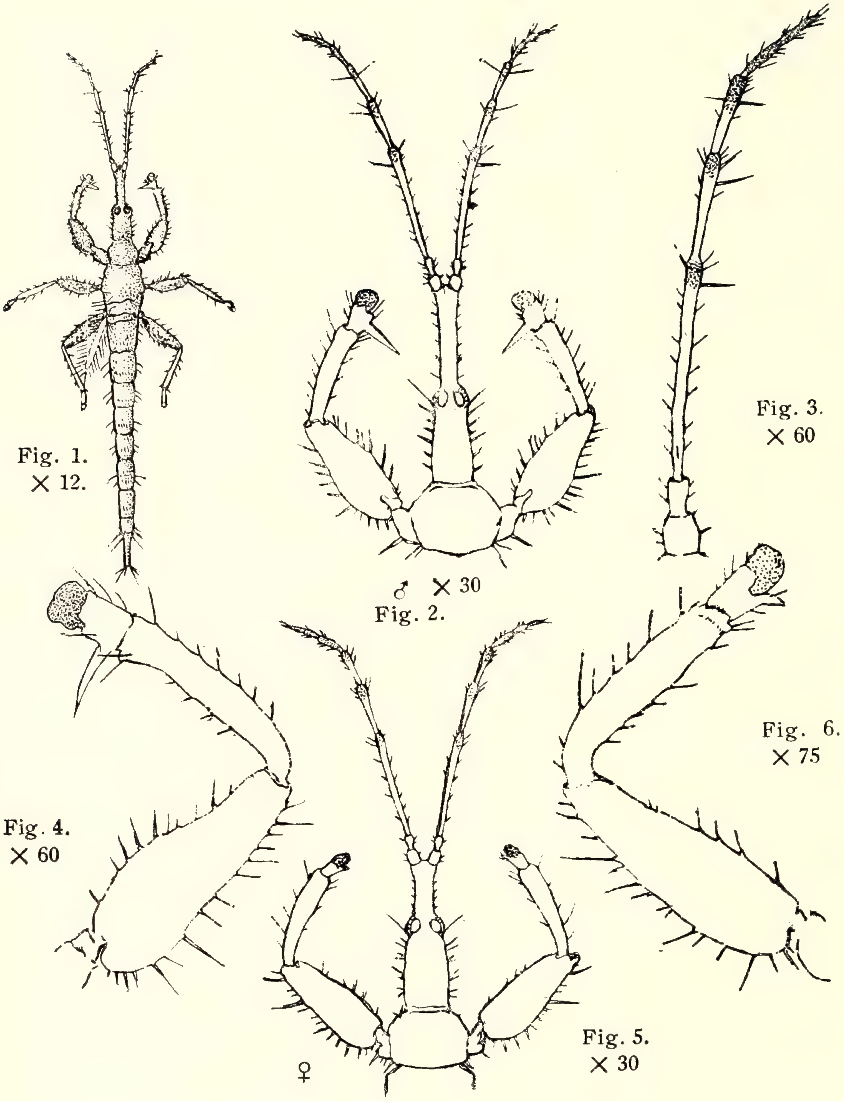


Fig. 1.
× 12.
♂ × 30
Fig. 2.
Fig. 3.
× 60
Fig. 4.
× 60
Fig. 5.
× 30
♀
Fig. 6.
× 75

Kleothrips subramanii Ramakrishna.

Fig. 1. Male insect × 12.
,, 2. ,, ,, anterior region × 30.
,, 3. ,, ,, antenna × 60.
,, 4 ,, ,, right foreleg × 60.
,, 5. Female anterior region × 30.
,, 6 ,, left fore leg × 75.

Oil of Valerian.—Lessens the excitability of the spinal cord and even paralyses it and also produces numbness in the brain. ' 2 cgm. (1/3 gr.) injected under the skin of frog have been found capable of preventing tetanic spasms after a like injection of 5 mgm. (1/12 gr.) of Strychnine. Given alone to these animals (rabbit and frog) hypodermically it impairs mobility and sensibility (Dymock). The oil is very efficient in the coma of typhus fever (Khory and Katrak). Oil of Valerian dissolved in ether is sometimes administered by inhalation in nervous headache or in cerebral congestion. The oil is used to a considerable extent on the continent of Europe as a popular remedy for cholera, in the form of cholera drops (E. J. Parry).

Jatamansi is still regarded as a valuable medicine in India and is much used by Ayurvedic physicians.

TWO NEW THYSANOPTERA FROM SOUTH INDIA

(*With a plate and a text figure*)

BY

T. V. Ramakrishna Aiyar

The two forms of 'thrips' noted below do not appear to have been recorded till now and are therefore described as new species. The first one is described as a species of the genus *Kleothrips*, Schm. of which there are no previous records from India, and the second as a species of *Leeuwenia* Ky. ; of this latter, however, Bagnall has described three Indian species, two *L. coriaceous* and *L. indicus* from Dehra Dun and Moulmein, and the third *L. eugeniae* from Kodaikanal, the last from material submitted by the writer. The very interesting fact with regard to the species of *Leeuwenia* described so far from different localities is, that most of them have been found on species of the plant *Eugenia*.

IDOLOTHRIPIDÆ

Kleothrips subramanii (*new species*)

Male.—(Macropterous.) (See Fig. 1) Length 6 to 8 mm. General colour dark brown to black ; the junctions of the abdominal segments and patches on the basal region of head and on the thorax appear reddish brown ; this is particularly so in some specimens. The bulged-out portions of the eyes, of a light greyish brown colour. *Antenna :* the first segment and the basal two-thirds of the second dark brown ; the distal third of the second light reddish brown and the sixth, seventh and eighth dark greyish brown ; the third, fourth and fifth segments yellowish white covered with greyish brown at the distal region. In the third the greyish patch is found only at the extreme distal end, while in the fourth and fifth this colour covers a third to half of the segment towards the distal region ; in the fifth the greyish colour is of a dark hue and resembles the colour of the distal segments.

Fore femora dark brown, of a lighter tinge at its junction with the coxa. Fore tibia and tarsus (except the distal portion which is dark) reddish to yellowish brown, the lateral margins of the tibia dark, and the tarsus and tarsal tooth of a distinctly lighter colour approaching yellow. Intermediate and hind femora dark brown ; the tibia also of same colour but with the basal and distal regions yellowish brown. Wings clear with the cilia having light brownish tinge. The Cephalic spines and bristles dark, those on legs and antennæ light to dark reddish brown, and those at the sides of the abdomen and at the end of the tube are of a yellowish brown colour.

Head :—The vertex before the eyes very strongly produced carrying the two antennæ far forwards ; the produced portion from before the eyes to the base of the antennæ is 1·25 times as long as the portion behind the eyes and five times as long as the breadth of head across eyes. (See Fig. 2) The head is broadest at the base close to the prothorax and narrowest just in front of the eyes. The vertex is distinctly narrower than the basal region and its sides are more or less parallel but diverge a little at the extreme anterior end where the antennæ are attached ; as such the vertex is broadest just behind the bases of the antennæ. On both margins of the head from behind the base of the antennæ right up to the prothorax are numerous spines and bristles, but those on the vertex are not so conspicuous as those on each genal margin behind the eyes ; on each side of the vertex there are from 8 to 12 small sharp bristles and of these the basal two, one on each side in front of the eyes are the most prominent. Behind the eyes on each side of the head there are five or six well-developed sharp and conspicuous spines some of which arise from short warts. In addition to these there is a very long and slender supra-ocular bristle projecting forwards and outwards above the eyes. Some of these cephalic bristles often break off while handling and are not therefore complete in many specimens.

Eyes prominent and bulging out ; about 1/10 the length of the whole head. Anterior ocellus situated in the middle of the base of the vertex just in front of the eyes, the other two not clearly seen.

Antennæ (See Fig. 3) length 2–2·125 mm. 1 1/3 times as long as the whole head. The first and the second segments short stout and more or less cup-shaped with a few sharp bristles at the sides. Third segment very long, considerably longer than every other segment. The third, fourth and fifth each bears a prominent long bristle at the distal end directed outwards ; in the fifth there is a similar one at the same region directed inwards. The sixth has a pair of similar bristles at its middle one on each side. Besides these, there are smaller bristles and hairs in all the segments and groups of sense cones in the distal ones. The terminal segment which is not acutely pointed has a hair at its tip.

Prothorax.—·26 times as long as head and including the coxæ it is 1·875 times as wide as long ; in shape more or less hexagonal and provided with a few bristles ; the bristle at postero-lateral margin is sharp and conspicuous ; there are only one or two small ones on the antero-lateral margins. The posterior angle of the coxa also bears a prominent bristle parallel to the one on the postero-lateral margin of the prothorax.

Legs.—(See Fig. 4) Fore femora broad and swollen, broadest just before middle and then narrowing towards tibia ; both margins well supplied with several long and short sharp spines ; those along the outer edge more numerous and some of them are strong and rise from warts—about a dozen such spines at the outer and about 8 or 10 along the inner margin. Fore tibia with the inner margin distinctly curved, broadest just before its junction with tarsus ; at this point the inner edge forms a small conical projection bearing two or three transparent hairs. The tibia bears only a few inconspicuous bristles and that along the outer margin. The tarsus has a prominent long basal tooth rising at right angles from its inner margin ; the tooth is as long as the tarsus itself.

The intermediate and hinder legs are normal in structure, the femora are not swollen or unusually broad, the tibiæ not short and curved, nor do the tarsi bear any tooth ; there are, however, bristles conspicuous along the outer margins of the femora and tibiæ.

Wings.—Uniformly broad, with the marginal cilia long and numerous. About thirty accessory hairs on hind margin near apex. The wings do not extend beyond the 5th abdominal segment.

Abdomen.—Long and gradually narrowing towards the tube measuring over 2/3 of the whole body, breadth of 8th segment half the breadth of the abdomen at base just behind last leg. Tube 1 1/3 times as long as eighth segment, breadth at tip 2/3 of that at its base with half a dozen long bristles at the tip. The abdominal segments have each a group of three yellowish white bristles on each lateral margin ; some of those on the 9th segment are particularly long.

Measurements of holotype male : Total length 7 mm.

Head.—Length 1·442 mm. ; length of produced portion of head in front of eyes ·756 mm. ; length of eyes ·126 mm., length of basal portion of head behind eyes ·560 mm., breadth across eyes ·28 mm., in front of eyes ·154 mm., behind eyes ·266 mm., at base of head ·315 mm. Prothorax length ·364 mm., width including coxa ·770 mm. Abdomen greatest breadth ·630 mm. Tube, length ·525 mm., breadth at base ·105 mm., breadth at apex ·70 mm.

Antenna total length ·1,953 mm.

Antennal segments	I.	140	V.	266
Length in (*u*)	II.	105	VI.	140
	III.	840	VII.	70
	IV.	315	VIII.	77

Female macropterous.—Length from 5 to 5·5 mm. General colour similar to male. In structure there are definite variations. The produced vertex in front of the eyes is not so long as in the male, the fore femora are not so broad and swollen, and the fore tarsal tooth is very much smaller and reduced to a small short and curved tubercular projection.

Head.—(See Fig. 5) About three times as long as breadth across eyes; the length of produced portion of head in front of eyes is only ·75 of the length of the basal portion behind eyes, and is 1·1 times as long as breadth across eyes. Besides the long and weak supra-ocular bristle the usual cephalic bristles are present, though they are fewer and somewhat weaker than those in male.

Prothorax—2·34 times as broad as long with the usual bristles. *Legs.*—(See Fig. 6) Fore femora and tibia not so swollen and broad as in male and provided with fewer bristles, fore tibia not curved, fore tarsus with a small tooth-like curved projection at its inner margin very much smaller and weaker than the one in the male. Hinder legs normal with the usual bristles.

Abdomen.—Broader than male at base, 1·2 times as broad as Pterothorax. Tube is 1·8 times as long as eighth segment and ·6 times as long as head, bristles of ninth segment very long.

Measurements of allotype ♀ Total length 5·5 mm. *Head*, length ·826 mm. length of vertex before eyes, ·308 mm., of eyes ·112 mm. and of basal portion behind eyes ·406 mm., breadth across eyes ·266 mm., in front of eyes ·133 mm., behind eyes ·259 mm., and at base of head ·322 mm. *Prothorax*, length ·315 mm., breadth with coxa ·595 mm. *Abdomen* greatest width ·735 mm., length of eighth segment ·280 mm., Tube length ·490 mm. *Antenna* total length, 1·197 mm.

Antennal segments, length in (*u*)

I.	105	V.	168
II.	77	VI.	105
III.	420	VII.	56
IV.	189	VIII.	77

Described from about ten specimens of each sex. Collected from galleries in the leaves of the palmyra palm (*Borassus sabelliformis*) damaged by the caterpillar *Nephantis serinopa*, a serious caterpillar pest of palms in South India, in the Chingleput District, South India. They were collected on three different occasions by my colleague, T.V. Subramanyam, after whom I have named the interesting species. Mr. Subramanyam says 'Though this "thrips" was collected from *Nephantis* attacked leaves on all the occasions, the economic relation between the two is not yet clear. One specimen was noted to lay 18 eggs on the palmyra leaf. The peculiar habit of brooding over the eggs was observed for a whole day after egg laying. On the second day the eggs get a brownish tinge and on the following day they hatch. The young larva has the body tapering at each end. I could not rear out the nymph any further, as I was not able to find out the actual food of the insect.'

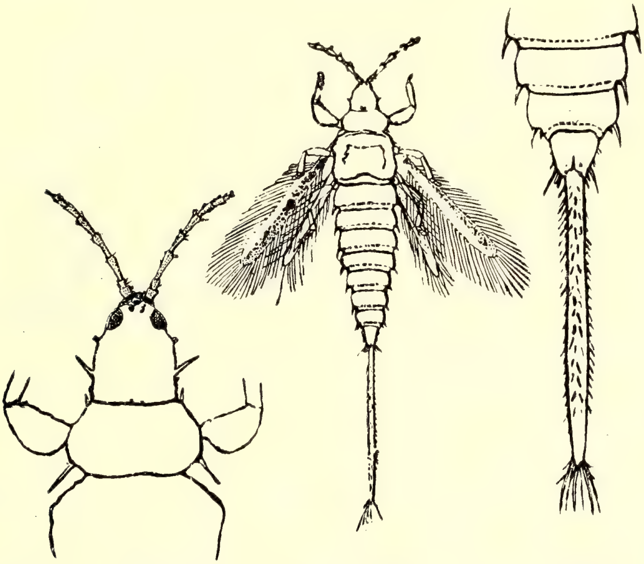
Pre-adult nymph of male has the body bright red and the wing rudiments and limbs transparent shining white, eyes and apex of tube dark.

The insect is without doubt an undescribed form and I have made it out to be a species of *Kleothrips* Sch. Dr. Karny to whom specimens were submitted for specific determination is of opinion that the insect is quite different from all species of *Kleothrips* known to him, that it closely resembles his genus *Acrothrips* and may even be a new genus allied to these two genera, because of the extraordinary length of the vertex of the head and the abnormal length of the third antennal segment. I have, however, described it as a *Kleothrips* for the present, and as far as I could make out is distinct from the few known species described till now by Schmutz, Karny, and Hood. This appears to be the first record of a species of *Kleothrips* from India, the few previous records being from Ceylon, Malayasia, Africa and Australia.

HYSTRICOTHRIPIDÆ.

LEEUWENIA KARNYI Ramakrishna (*new species*)

Length including tube 3 to 4 mm. General colour dark to light chocolate brown. Eyes dark, ocelli brown, pigment reddish brown. First segment of antenna concolourous with head, second of a light brown and third to eighth clear pale yellow. The median dorsal region of head, all the femora and the front tibiæ of a more or less lighter brown than the rest of the body. The genal and prothoracic spines, the lateral abdominal spines and the bristles at apex of tube transparent light yellowish brown. Wings infumated along middle with a light brown patch. Cilia dark brown.



X 84
Fig. 2

X 28
Fig. 1

X 84
Fig. 3

LEEUWENIA KARNYI Ramakrishna

Fig. 1—Adult Insect X 28.
Fig. 2—Anterior region X 84
Fig. 3—Hind region X 84.

Head.—1·25 times as long as wide, broadest at the base, the sides gradually narrowing towards eyes ; eyes large and prominent, oval, $\frac{1}{3}$ as long as the whole head, and, the breadth across the eyes $\frac{2}{3}$ of that at base ; ocelli clear, the hind ones placed at the anterior edge of the vertex just below the base of the antennæ and on a line with the anterior edge of the eyes, the front ocellus overhanging at edge of the vertex. Cheeks behind the eyes finely crenulated with one conspicuous spine on each side midway between the eye and the base of head ; there are in addition a few very minute isolated setæ arising out of the crenulated cheeks, especially just behind the eyes. Antennæ, nearly 1·75 times as long as head, first and second joints short and stout, the first equal in length to the last, third longer than the fourth, fourth equal in length to seventh and eighth together ; the fourth, fifth and sixth are broader distally. Mouth cone broadly conical extending beyond the middle of prosternum.

Thorax.—Prothorax—about $\frac{3}{4}$ as long and 1·5 times as broad as head ; short anteriorly directed spine at the antero-lateral angle and a stout long one directed backwards sideways at each posterior lateral angle, the latter rises from a tubercle and is slightly longer than the one in each cheek. These spines get broken and are not visible in many prepared specimens.

Legs.—Fore femora flattened and with crenulated edges, fore tarsus unaimed, hind legs normal. *Wings* moderately broad and reaching to 7th segment of abdomen ; no accessory hairs on post margin.

The body surface on the head, thorax and the fore femora clearly reticulated showing numerous small cellular spaces.

Abdomen.—Stout built, the surface at the base reticulate ; at base 1·5 times as broad as the prothorax and gradually narrowing to tube. The abdominal segments are distinctly transversely produced and each has a strong conspicuous spine at the postero-lateral angle on each side ; these spines are directed backwards and are tuberculate at base. The spines of the 2nd and 3rd segments small, whereas those of the 6th, 7th and 8th are very prominent ; on the 8th and 9th segments there are one or two extra bristles near the above. Tube a little more than four times as long as head and slightly shorter than all the other abdominal segments together ; breadth almost uniform throughout; fringed with setæ but they are weaker and fewer than in *gladiatrix*, Ky., a little more than a fifth of the tube at the apical end without any setæ.

Measurements of holotype.	Total length including tube	3·8 mm.
	,, ,, of head.	·336 mm.
	,, ,, eyes.	·105 mm.
	,, ,, Prothorax.	·210 mm.
	,, ,, tube.	1·4 mm.
	Breadth across eyes.	·230 mm.
	,, at base of head.	·294 mm.
	,, of prothorax.	·420 mm.
	,, of base of abdomen.	·630 mm.
Breadth of tube at base ·091 mm.	Breadth of tube at apex	·063 mm.
	at middle.	·077 mm.

Antenna total length. ·581 mm.

Length of segments in (*u*)

I.	42	V.	91
II.	56	VI.	84
III.	112	VII.	56
IV.	98	VIII.	42

Described from ten specimens collected by me on leaves of *Eugenia jambolana*, Bangalore, January 1924.

Although in some features this species approaches Karny's *gladiatrix* from Java and Bagnall's Burmese form *indicus*, it is distinctly different. It is also quite different from *L. eugeniæ* recently described by Bagnall from South Indian specimens I submitted to him a few years ago. From *gladiatrix* it differs by the weaker setæ on the tube, in *eugeniæ* the tube is weaker than in this form and very sparsely clothed with short setæ. Karny's *aculeatrix* and *caelatrix* have the tube wider in the middle and covered with numerous conspicuous setæ. His *seriatrix* also has the tube covered with longer setæ. In *indicus* the tube is longer than the other abdominal segments and the wing retaining spines very poorly developed. The distinctive features of this species are the conspicuous single spine on each cheek and the transversely drawn out abdominal segments with the strong tuberculated spine at the posterior-lateral angle of each segment. Specimens were examined by Dr. Karny and he concurs with me in the opinion that it is a new species. I take the privilege of naming this species as a mark of my regard to this well-known authority on Thysanoptera.

BIRDS NESTING WITH A CAMERA IN INDIA

PART V

BY

CAPT. R. S. P. BATES

(*continued from page 609 of this volume.*)

(*With* 5 *plates.*)

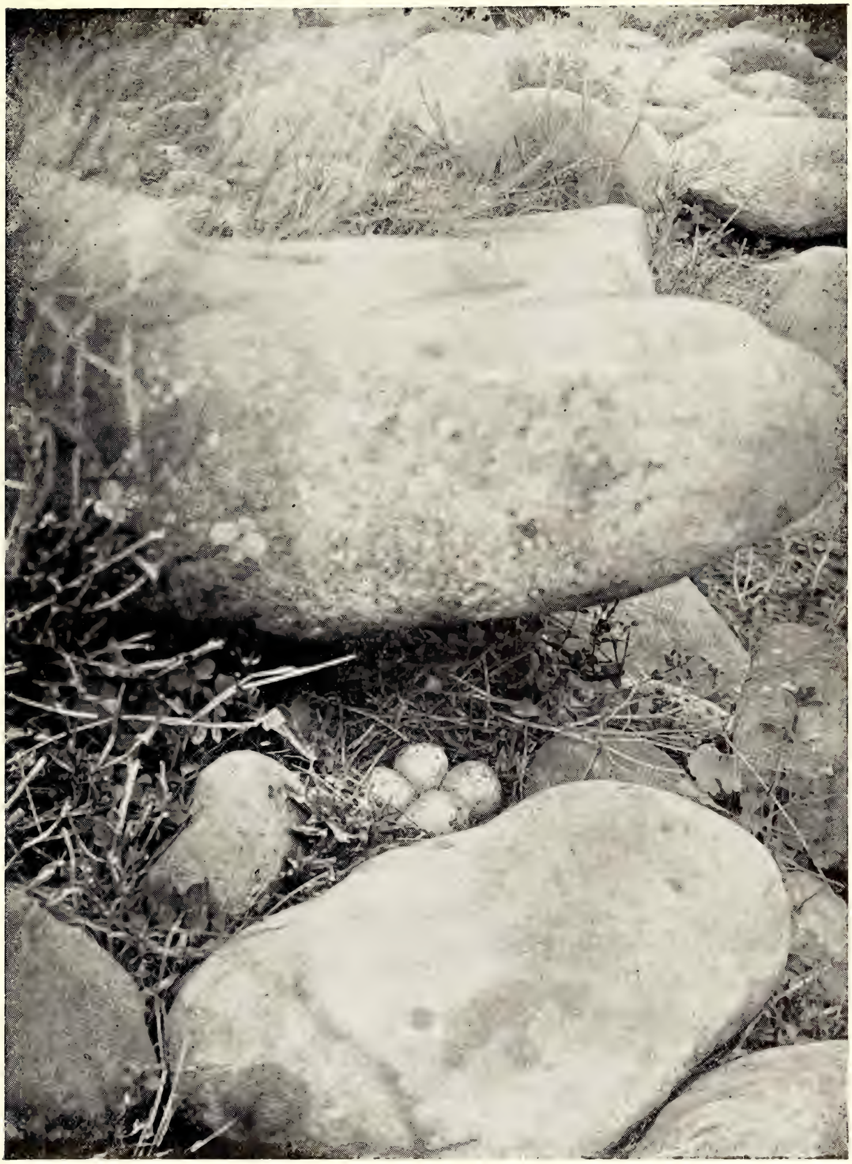
Ever since my arrival in India my ambition has been to depict, by means of the camera, the wonders of its immensely-varied avifauna. But, as the reader will readily understand, the difficulties in the way of the bird-photographer in this country are many; especially so in the case of the photographer who can only devote a very limited amount of his time to the task. True, the East has certain advantages over the West, as for instance the ease and cheapness with which one can move one's apparatus by means of that poor down-trodden human beast of burden, the Indian coolie. At home the ordinary mortal can only take out a very condensed equipment, as it generally means carrying it on one's own back, whereas here the quantity is only limited by the number of coolies one can afford to pay. In Kashmir when out in camp I invariably had an immediate following of three trekking along with me, consisting of two coolies carrying my two half-plate cameras, and their sheaths for a couple of dozen plates, a quarter plate reflex, and a case of lenses consisting of a Zeiss convertible, a Ross telecentric, and a Zeiss telephoto lens. The latter incidentally I have never used, although I certainly ought to have employed it on the Sooty Flycatcher's nest, the small photo of which appeared in the first of these articles. This nest was overlooked from an immense boulder at a distance of a few yards. These two men also carried my food for the day as an added burden, as well as sundry articles for use in constructing 'hides.' The third member was a shikari, who has now developed into an ardent egg-collector. He was of great use in looking for rests and of course carried my gun. I was thus enabled to travel unencumbered, my sole equipment being a pair of binoculars, a small folding hatchet and chisel clipped on to my belt and a long 'khud' stick. Nevertheless I fear the disadvantages of the climate very much outweigh the advantages, except of course in the hills, whither however this luckless mortal can only betake himself for but a short part of the year. In the plains the grilling heat of the summer renders the use of the 'hide' almost an impossibility. Can any one imagine the inside of a stuffy little tent about three feet square in a shade temperature of anything up to 110° or even more? The sequel to a couple of hours so spent I think I can well foresee; a hospital ward, hushed voices, and later a firing party. Developing is another difficulty during the summer months, since out in the blue one cannot procure tons of ice with which to cool one's solutions, and I well remember once losing a whole batch of excellent negatives in Rajputana, seeing them melt away before my very eyes before they could be dried.

There are of course other means to be employed in obtaining records of the birds themselves besides using a 'hide' as for instance the distant release, and the reflex camera, but both these are very limited indeed in their scope of application. The first method entails disturbing the bird after each exposure, and I have never yet discovered a device of this nature, which worked really satisfactorily. As regards the use of the reflex I have been in possession of a really suitable one for some time now, and have as yet produced but one entirely satisfactory negative with it, that is using it legitimately as a super hand-camera. Still I have great hopes, as I cannot conceive of a more certain method of obtaining good results amongst nesting colonies of water-birds, such as Egrets, Cormorants, Painted Storks, etc., than the reflex, and I am consequently looking forward to the coming breeding season of these birds with considerable eagerness.

On the occasion of my second visit to Kashmir, the climate of that glorious country being all that could be desired, rendering the use of a 'hide' both possible and pleasant, I determined to see what I could do with a tent I had ordered to be made at a Cawnpore firm and forwarded to that very well known personage in Srinagar, Mr. Samad Shah, to await my arrival.

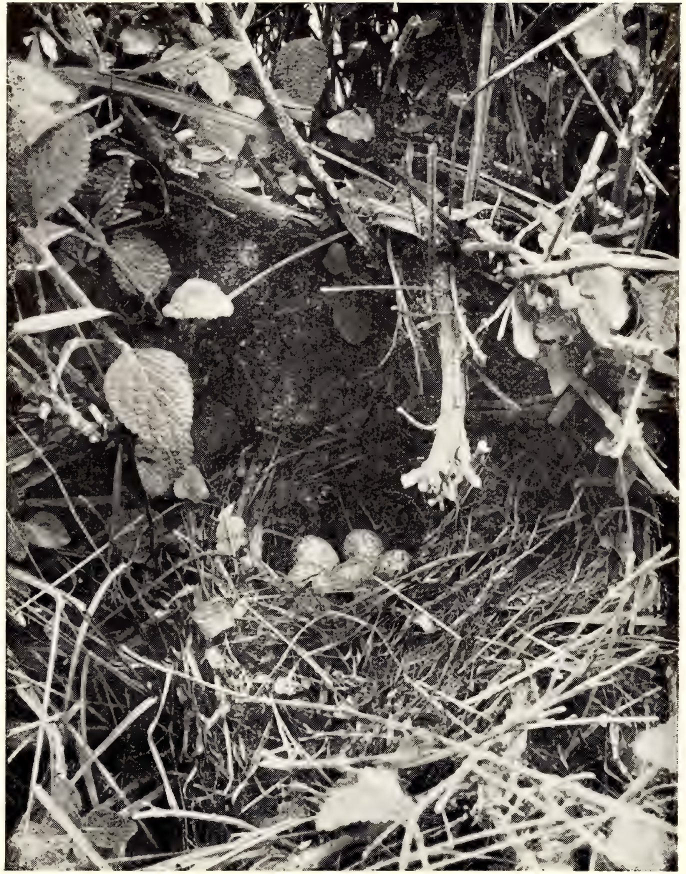
Being India, of course the order of things was reversed, and it appeared that I was expected to waste my leave awaiting the arrival of the tent. I struck, with the result that I reached Bandipur on the shores of the Wular lake on 22nd May, with nothing more suitable than one of those large umbrellas usually associated with surveyors. As a matter of fact it turned out to be invaluable and under the circumstances I could not have had anything better, although the next time I go to this particular spot, I shall take with me a collapsible canvas box, which I am having constructed with the outside camouflaged to represent a boulder. This I think will simplify matters considerably, as building a 'hide' from sods or stones, or even putting up and camouflaging the usual type of tent, is apt to waste valuable time, and the two former being immobile all the resultant photos can only be taken from the one standpoint. Of course nothing can be more suitable than a hide constructed from the very material in the vicinity of the nest, as harmonization is often half the battle. Also a 'hide' of a fixed shape cannot always be employed, so such a box in the outfit would only be supplementary to the ordinary hiding tent.

I had the houseboat towed laboriously up the Madmatti as far as it could be got, and then set off along the river bank to see what I could find in the couple of hours of daylight which still remained. Rounding a bend only a few hundred yards above the boat, I came in sight of a small patch of stones on the opposite side of the river, in the middle of which two stranded logs lay one across the other with a small heap of brushwood lodged against them. My eye at once caught the movement of a Jerdon's Little Ringed



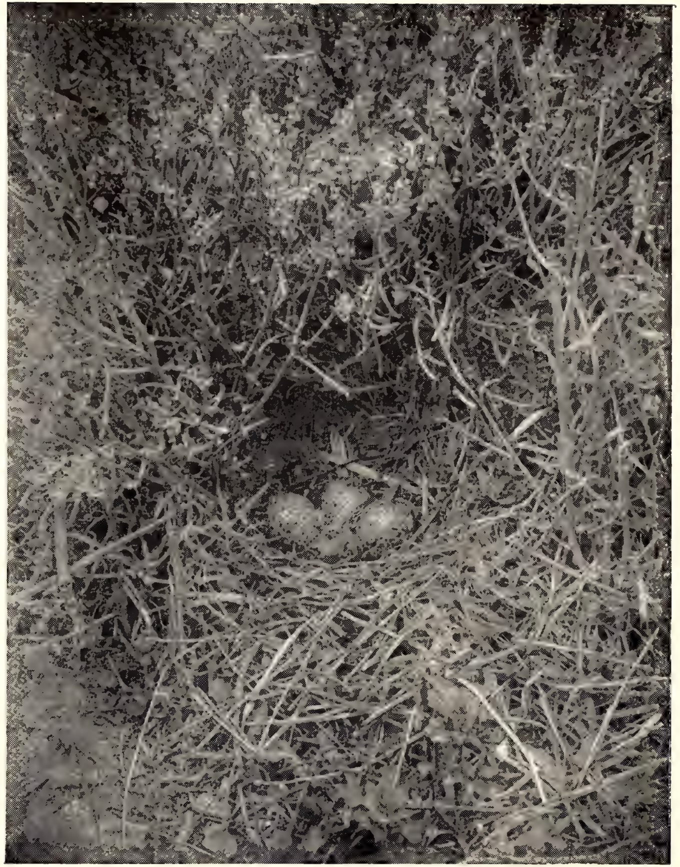
THE COMMON SANDPIPER

(*Tringa hypoleuca*)



Hodgson's Pied Wagtail

(*Motacilla alba hodgsoni*)



The Common Sandpiper

(*Tringa hypoleuca*)

Plover (*Charadrius dubius jerdoni*) between these logs and the water's edge, and watching it carefully through the glasses, I saw it settle down in a slight depression only a couple of yards from them. As luck would have it, this turbulent river was here broader than usual, so I was able to ford it, and, on reaching the spot, I found a nest containing but one quite fresh egg, only after a considerable search however, as the egg so blended with the shingle amongst which it lay, that unless one looked straight at it, it literally melted into its background.

With the assistance of the shikari whom I had taken out with me I pulled down the upper log and laid it parallel to the other one, thus making an excellent foundation for a 'hide' to use when the bird commenced sitting. As a matter of fact next morning the egg had disappeared. Why I wonder ?

A little further up I found a Hodgson's Pied Wagtail's (*Motacilla alba hodgsoni*) nest with large young ones in it. It was inside a wide cavity under the overhanging bank of the river, and would not have made a good photograph. Their nests are excessively common in May and I was certain to find other and more suitably placed ones, so I left them in peace and went on beyond the little village of Dachhgam to where there are large patches of stones and shingle on either side of the river, on which I knew from my experiences there the year before, that the Jerdon's Little Ringed Plovers breed in considerable numbers. Nor was I disappointed on this occasion, as I soon spotted many of them pottering about, some undoubtedly attending to young ones.

I then followed out my usual procedure ; walked boldly into the middle of a large patch to disturb any birds which might be sitting, and then retreating about a hundred yards, I took up a convenient position screened from view by a tree trunk, and got out the glasses. Very soon I noticed a bird making its way back across the stones in short runs, halting between each little advance to spy out the land. At length it appeared to have reached its objective, and to have settled down. I now set off towards the spot, never taking my eye off it for an instant ; yet, when I arrived there, nothing whatever could I see beyond endless stones. The bird had slipped away of course the moment I left the shelter of the tree, running in a series of short zigzags until it reached the river bank, and was now whistling plaintively from the opposite side of the river whence it had betaken itself on my nearer approach. I repeated the performance a second, and yet a third time, and was almost on the point of giving up the search, when I discovered that I was standing within six feet of a nest of four eggs. At times I must have been within an ace of treading on it. It is really almost unbelievable how one can fail to pick out these eggs from their surroundings. A more striking example of protective colouration it is impossible to cite. The birds, too, blend extraordinarily well with the stones, and even with binoculars it is most difficult to keep them in view, except when they are actually moving. This nest turned out to be in practically the identical spot, in which I took a nest the previous year on the very same date.

This time there were no convenient logs, so I impressed two villagers into my service, and in a very short time we had raised a low circle of stones eight or nine feet from the nest, and about two and a half feet high. Just roomy enough inside to take myself cross-legged and my camera.

Returning next morning, I was gratified to make out the bird sitting quite peacefully on the nest. I was soon inside the 'hide' with the half-plate camera in position. Samad Shah's khaki umbrella made a perfect roof to the sangar, and when covered with a few leafy branches did not look a bit terrifying. I was really very comfortable and quite cool, the chinks between the stones providing quite good ventilation as well as the requisite peep-holes. The only difficulty was that the pole of the umbrella impeded my movements somewhat, as I had to sit with a leg on either side of it, and work with it just in front of my nose the whole time.

I was engrossed placing slides and other paraphernalia in more convenient positions, when, glancing through a chink I had purposely left open as my main spyhole, I was surprised to find that the bird was already seated calmly on its eggs. She must have returned the very moment my minions had left the stones. I had expected a considerable wait, as we had been working around the sangar for a good half hour, and it certainly must have looked a much more formidable structure than it did before our advent. She sat quite still and broadside on, only looking to right or left every few seconds, so I was very soon at work.

The click of the shutter had no effect on her at all, but in changing the plate holder, I inadvertantly knocked it against the umbrella pole. The sudden rap made her jump off the eggs in a bit of a hurry, but she only ran a couple of yards, then, seemingly thinking better of her cowardice, turned round and walked slowly back to the nest, close to which she stood for a moment, eyeing the 'hide' with a certain amount of distrust before settling down on the eggs again. She never seemed to notice the camera at all; partly I suppose, because it was well back in the shadow, the walls of the sangar being about 18 inches thick; and partly because I was only using the back components of the lens in order to get a larger image. As I was using a Zeiss convertible lens with a between-lens shutter, only the black shutter-leaves presented themselves to her. After two or three more exposures she entirely ignored the slight noises I was making in changing plates and resetting the shutter. In fact the more I made the stiller she became, which of course was all the better for me. I supposed, wrongly as it happened, that far from ignoring these sounds, as time went on, she was growing more and more suspicious and so listening the more intently; and I felt certain that it would take very little indeed to make her quit the nest. Some species, many of the Thrushes for instance, obviously behave in this manner. Yet on the other hand it is patent that with many other birds, suspicion only tends to make them move the more. Their heads go twisting round in every direction and they become so restless that it is almost impossible to get unmoved negatives of them.

I now bethought myself of trying to obtain a negative or two of the bird standing over the nest, and with this purpose in view I lightly tapped the umbrella post to induce her to get up. To my surprise she never moved: a hiss produced no result: I mewed like a cat: I whistled: I spoke: I shouted: I went through my entire repetoire of popular ditties in the hopes that she might turn out to hate rag-time as much as I do: all to no purpose. She sat like a rock, evidently being quite used to subterranean noises, even of the strangest character. In despair I moved the camera, and pushed out a corner of the red focussing cloth. She went off like a streak: I feared for good and all, so, instead of replacing the half-plate, I leisurely rigged up in its place a quar.er plate reflex, which, I am sorry to say, I had also brought out with me. The entire batch of plates, which I had bought for this camera in Murree on my way up, turned out to be bad, and I exposed half a dozen on her in most excellent positions, before I closed down operations, not one of the resultant negatives of course turning out satisfactory.

Incidentally she had returned just as the reflex was ready, and had posed most beautifully for the first exposure, standing just behind the eggs looking down admiring them. I could have gone on exposing plates on her all day, making as much noise as I liked. Such behaviour on the part of so wily and shy a bird is almost unbelievable, but, as I have remarked elsewhere, birds vary in temperament as enormously as do human beings, and it is quite on the cards that the next Jerdon's Little Ringed Plover, on which I experiment, will be too shy to put in any appearance at all. I have since had further experiences of the same sort and it is now quite plain to me that to a great extent with birds 'only seeing is believing.' The evidence of hearing may arouse their suspicions but it is not enough, and as time goes on they pay less and less attention to the noises from the inside of the hide. It is not until they have the actual evidence of sight that suspicion turns to fear and that they can appreciate the presence of danger. I find that after being in the 'hide' for a time one can often talk and make as much noise as one likes, but if one accidentally or intentionally hits the sides of the tent so that movement becomes apparent the bird will leave the nest like a flash in an absolute panic. In the dark room, besides discovering that the quarter plates were all spoilt by damp, I was rather annoyed to find that the half-plate negatives were all pretty badly under-exposed. As the day had been an excellent one for photography, there being a thin film of cloud, just sufficient to soften the shadows somewhat, this was rather mystifying, until it dawned on me that I had completely overlooked the fact that I had been using only half the lens, and had stopped down the aperture, as if I had had the complete lens in use. Accordingly the next morning I returned once more to my scene of operations—only to find an empty nest. These eggs, too, had disappeared? I strongly suspect that the shikari was the culprit. He probably thought that I had finished with the nest. In Kashmir large numbers of Terns' eggs are taken by the villagers. In fact it is a marvel to me that the Terns manage to breed at all. Hence I see no reason why they should not also have discovered that these Povers' eggs too, are a great delicacy. The gentleman in question of course denied all my accusations.

On the way back to the boat for tiffin I investigated an Eastern Jackdaw's (*Corvus monedula sœmmeringii*) nest in a hole in a high bank just opposite the village. I seem to remember taking eggs from this very hole the year before. This time it contained four young ones. I tried to get a photo of the parent birds entering it, using a distant release, but they objected strongly to the bright lens of the camera, and would not approach anywhere near it. In a tree close to the house boat was a Rufous-backed Shrike's (*Lanius schach erythronotus*) nest, containing five eggs.

The next day I left the boat, and moved up the river as far as Sonarwain. I was now keen on trying my luck with Common Sandpipers (*Tringa hypoleuca*), as on the islands, and to a lesser extent along the banks of this river, these birds breed most profusely. The islands, to which I have referred, are most numerous, and vary in size from little stoney patches a few yards long to well-covered stretches up to two or even three hundred yards in length. They are generally clothed with a sufficiency of low brushwood and soft undergrowth. Stranded logs and driftwood are dotted along their edges, the stones of which are continually moistened by the drifting spray from the boiling waters of the torrent. To reach many of the islands is an arduous and somewhat hair-raising task, as one would have a pretty rough time of it, should one loose one's balance and get swept off one's feet. We used to link arms, and work our way across in a string of three or four. We could then help one another over the difficult bits. The roar and swirl of the water used to half hypnotise me, and at times I really and truly felt it quite an effort to concentrate my mind on the task of standing up against the buffeting of the powerful current.

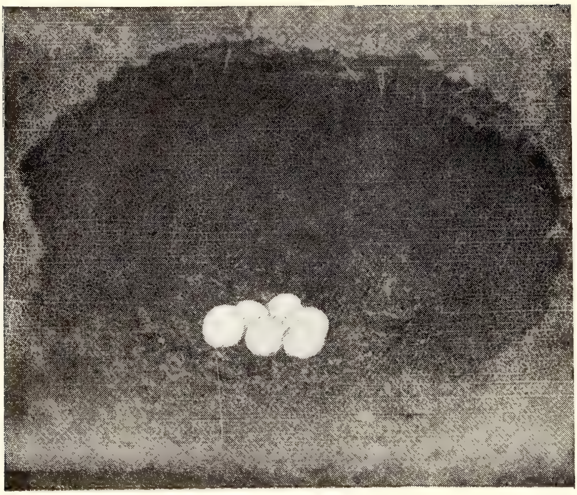
To show to what an extent the Sandpipers patronize these islands, I remember that in the previous year on one small island only about 40 or 50 yards long we found four nests, and during a morning spent in going from one island to another, we found so many that we didn't trouble to keep count of them. As far as I recollect the majority of these nests were above Sonarwain, and on this occasion I only found one with eggs below that place. There were plenty of birds about however, and I noticed a good many scratches. This nest could not have been in a better situation for my purpose, so after its discovery I did not take so much trouble in looking for others, which probably accounts, of course, for their seeming scarcity as compared with the previous year. As before we built a small sangar of stones, but this time only six feet away from the nest, and left it till the following day for the bird to get used to it.

Continuing up stream, I came across two nests of the Kashmir Roller (*Coracias garulla semenowi*), both containing fresh eggs; one three; the other four. These were both in cavities in the river bank, and in one the eggs could be plainly seen without enlarging the entrance, as it was merely a large chamber about a foot deep and

The Common Sandpiper
(*Tringa hypoleuca*)

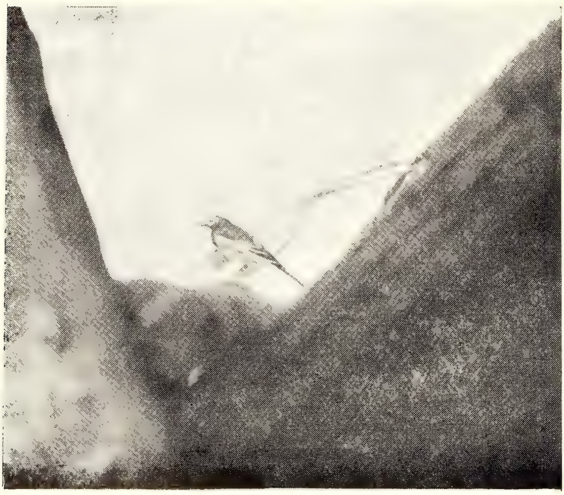
Jerdon's Little
Ringed-Plover
(*Charadrius dubius jerdoni*)

Jerdon's Little
Ringed-Plover
(*Charadrius dubius jerdoni*)



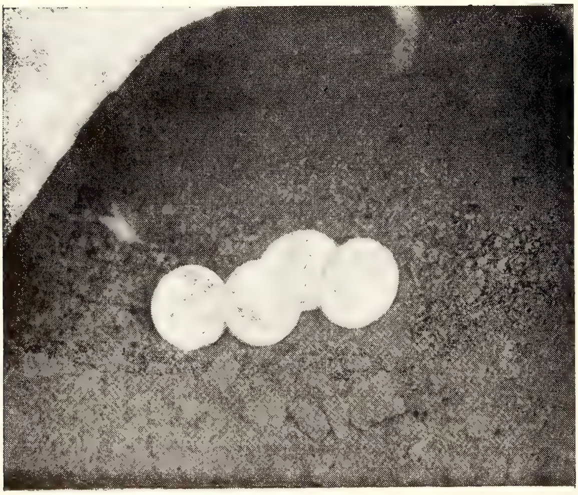
THE INDIAN PIED KINGFISHER

(*Ceryle rudis leucomelanura*)



HODGSON'S PIED WAGTAIL

(*Motacilla alba hodgsoni*)



THE KASHMIR ROLLER

(*Coracias garulla semenowi*)

nine inches wide with a slightly narrowed doorway. The eggs lay on the bare sand, amongst which I noticed many small particles of the hard parts of those large flying beetles. As I expected, Hodgson's Pied Wagtails proved very common, and I lit on no fewer than four nests before tiffin; two with eggs and two with young. I completely failed as regards Indian Pied Kingfishers (*Ceryle rudis leucomelanura*). They were numerous along the lower reaches of the river, and at this very time in the previous year I found two nests with fresh eggs. As I badly wanted a half-plate photo of a nest of these birds, I was rather disappointed not to be able to repeat the performance this time, especially as I also wanted to see whether fish bones are always made use of, as the eggs in the one and only nest I have ever opened up were on quite a thick layer of small bones, which, by the way, are plainly visible in the photograph. A coolie brought me one of these birds, which he had actually caught in its tunnel, which however contained no eggs. When I took it from him it snapped at my hand, so to test its strength I let it nip one of my fingers. I very quickly regretted it too as the edges of its bill were decidedly sharp, and it hung on so firmly, that had I attempted to slide my finger out without first prizing its mandibles open, it would certainly have cut through the skin. As it was the flesh felt bruised for some time afterwards. Incidentally it made no attempt to transfix me with the sharp point of its dagger-like bill, which I should have thought would have been a much more suitable means of attack for such a bird. At the bridge at Sonarwain I met with the little Plumbeous. Water-robin (*Rhyacornis fuliginosa*). From here onwards they are quite common along with their near relative the White-capped Redstart (*Chaimarrornis leucocephala*). Below this point I have never seen either of these pretty little birds.

On this day I got one very interesting photograph of two young Jerdon's Little Ringed Plovers. I was walking over a large patch of stones, across the middle of which there flowed a tiny stream. Hearing a very agitated plover about fifty yards off on the opposite side of the beck, I looked round to see what the trouble was, just in time to see two baby plovers struggling through the water. They gained the other side, and started off to where the mother bird was still plaintively calling to them, but as soon as I approached, they hid behind a stone little larger than themselves. During the whole time I was operating upon them with the camera, they never moved a muscle, but, as soon as I turned my back to go my way, they scrambled off towards their perturbed parents.

After tiffin I built a rough 'hide' close to a Grey Wagtail's (*Motacilla cinerea melanope*) nest in the roots of a bush on a small island just above the bridge, and from this I exposed the entire contents of another box of quarter plates. These incidentally were as bad as the others, so after this I gave up all idea of using the reflex at all. The bird was inordinately tame, and after I had made a couple of exposures, I demolished the greater part of the hide, and sat almost in full view of her. She continued to sit quite peacefully for a number of exposures, but when I completed the demolition process, she seemed to think that I had carried things a bit too far, and leisurely walking off the eggs, refused absolutely to pose any longer.

The following morning I went down to try conclusions with the Sandpiper. The umbrella was fitted on top of my sangar as before, and well covered with leaves, branches and grass, and I prepared to await the arrival of my victim. I had only about quarter of an hour to wait, but soon realized that here was a very different personage from the Jerdon's Little Ringed Plover. Never still for an instant, she was possessed of the most acute hearing, and glanced to right, left or behind her at the slightest sound, continually bobbing her head, as if suffering from a severe attack of the hiccoughs. I began to despair of getting good negatives, as I wanted to give exposures of at least half a second. However, she seemed to quieten down a bit after ten minutes or so, so I determined to press the release immediately after one of her habitual hiccoughs, and trust to luck. She seemed to me to be off her nest almost before the shutter had opened, but as a matter of fact this turned out to be the best negative of all. Although she had left so abruptly, I could see her standing at the water's edge only about three yards off, evidently thinking things over, and almost before I had had time to change the plate, she was on the way back.

I now made a horrible discovery. A piece of black cloth, draped across the window of the sangar just below the level of the lens, had fallen outwards, and she was certain to see my hand the moment I attempted to reset the shutter. However I had to risk it, and it would be interesting to see what she would do. She was now at the nest again, but away she went the moment my fingers appeared by the lens. Nevertheless within ten minutes she was back at her post once more, but this time facing the spot whence the terrifying apparition had emerged. The noise of the shutter alarmed her, but she remained sitting, until my hand once more appeared on the scene. This time it was over twenty minutes before she dared to come back, and after a third exposure and its attendant reappearance of my hand, she gave way to her fear and refused absolutely to come anywhere near.

I have often wondered what her thoughts were, when the top of what I presume she took for a more or less inoffensive heap of brushwood and stones, probably harbouring a snake at most, suddenly heaved up, and gave forth that much feared and clumsy animal a human being ; for, when I lifted the umbrella and stepped out from my cramped quarters, she was standing on a stone in the water about fifteen yards away. Four days later, when I again passed the spot, I was very gratified to make her out still sitting on her eggs, beside a tumbled-down ' hide.'

I moved my tent next day further up stream, to where the hills close in on either side, and the river is narrowed down to a boiling torrent sweeping round and over high boulders, whose ledges and clefts provide perfect situations for nests of the Himalayan Whistling Thrush *(Myiophoneus horsfieldi temminckii)* and the Indian Brown Dipper *(Cinclus pallasii tenuirostris)*, Plumbeous Water-robins and White-capped Redstarts are here commoner than ever. Hodgson's

Pied Wagtail does not appear to come up as far as this, but the Grey Wagtail is plentiful. These latter are pretty early breeders, and at the end of May I failed to obtain fresh eggs. I discovered one soiled and three perfectly neat and clean nests of the Himalayan Whistling Thrush, but was unable to find one with eggs, and as regards the Brown Dipper I was even more unsuccessful, as but one decidedly ancient nest was all my search could reveal.

My one and only discovery here was a nest of the Plumbeous Water-robin with four well incubated eggs in it. It was in deep shadow and in rather an awkward position, being in the main fork of a willow, and about six feet off the ground. However a bank rose abruptly fairly close to it, so I decided to test the outcome of a brain-wave that had occurred to me after the unfortunate experience with the Sandpiper. Fortunately I did not expect to produce good photographs. Still I did obtain one passable negative, but it certainly is not worthy of reproduction.

I possess two half-plate cameras ; one with an ordinary Thornton-Pickard shutter—my favourite one ; the other with a 'Koilos' shutter, and I had found that I could screw in the lens and shutter of the latter camera on the inner side of the panel, and so inside the camera, so I cut a small hole in the bellows, through which I pushed the antinous release, and packed black tape round the hole to make certain that no light could get through to fog the plate. In this way after focussing, I had only to fold back the focussing screen, and I could see exactly what I was doing in the way of setting the shutter and the lens aperture, as I had the whole 'works' facing me. After the first exposure on the Sandpiper I had wanted to alter the exposure, but was unable to do so, as I could not possibly see what I was doing. Another advantage of this arrangement was that there was nothing bright and terrifying to startle the bird, there being merely a small black circle 'the shutter' (when using one half of the lens only) in the middle of a plain wood panel.

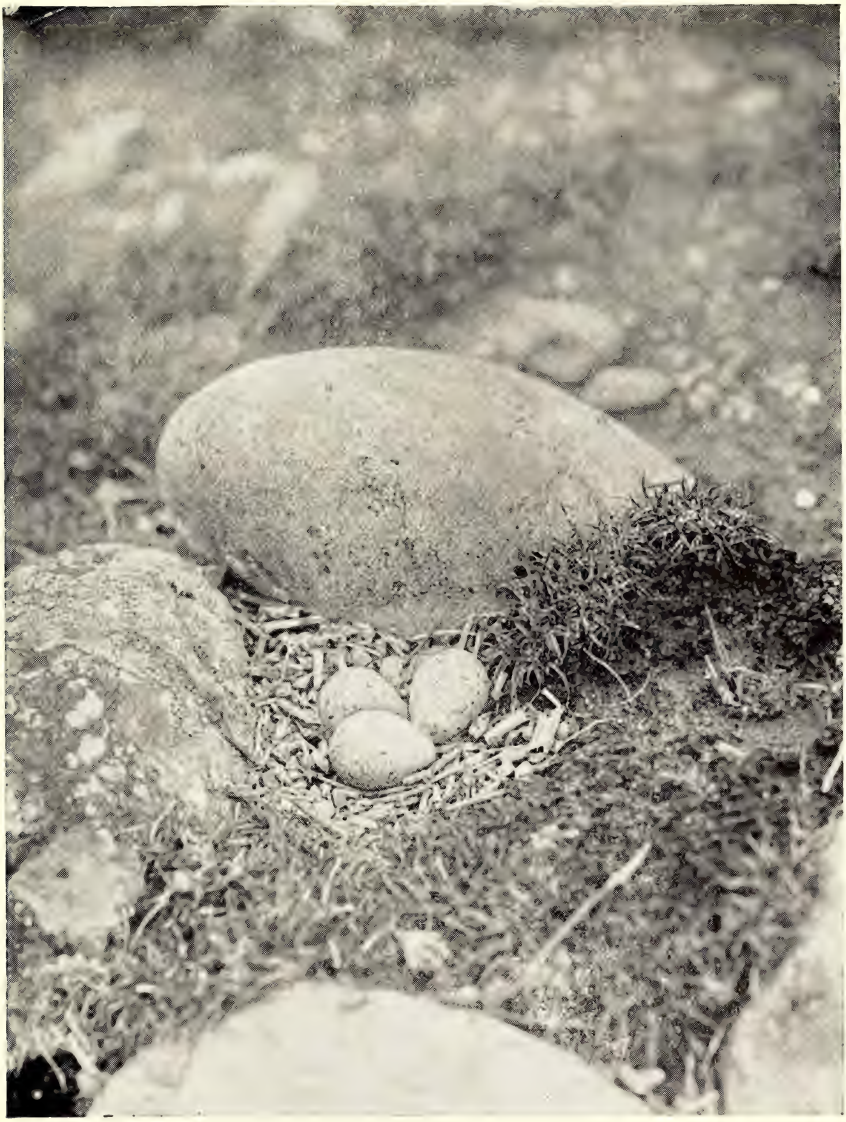
The experiment began just on nine o'clock in the morning with the lens and shutter in their ordinary position, and before I had been five minutes in the hide, the female flew up to the edge of the nest. She spotted the lens immediately and flew down to a boulder in mid-stream, before I had had time to press the release, even if I had wanted to, which I did not, as I think it tends to allay whatever suspicions the bird may have, if one waits a bit and lets her settle down. Until 11·30 o'clock she kept up a continual plaintive wail, occasionally flying up into the tree and approaching to within a foot or so of the nest, but never actually daring to come out into full view of the camera. During all this time I only saw the male once. For about ten minutes he added his voice to the lament, and then flew unconcernedly up stream again.

I then changed the lens and shutter round, screwing them on inside the bellows as I have described, and lo ! and behold the next time she flew up into the tree she straightway hopped onto the nest and settled down on the eggs. Either the click or the movement of the shutter itself startled her, and she went off again, and could not pick up courage to come to the nest for another half hour. It took me a whole hour to get off three exposures on her, and altogether I was sitting in that ' hide ' for three and a half hours. Still I am quite certain that I could have sat there the whole day with the works in their ordinary position, and would then have been compelled to give up in the evening without having exposed a single plate. Thus the experiment was really quite a success. It made all the difference to me inside the hide, as I could see absolutely what I was doing, and could alter the exposure or other gadgets without ever moving the camera, and risking giving my presence away, and the absence of anything startling facing the nest undoubtedly made a great difference to the bird's behaviour. In fact I think had I started off with the shutter reversed, I would have been able to get as many negatives as I wanted, as those two and a half hours of anxiety must have made her very jumpy.

In the afternoon, feeling a bit limp after my morning's work on the Water-robin, I lazed outside my tent, writing up my diary. The tree, under which I was seated, was frequently visited by two or three Himalayan Black Bulbuls (*Microscelis psaroides psaroides*), and after an hour or so of their raucous voices, I had serious thoughts of shouting for my gun. I have met with few more noisy and less musical birds than these, and with their untidy plumage they are veritable street arabs amongst birds. I could occasionally hear the hoopoe-like voice of the Himalayan Cuckoo (*Cuculus optatus*) higher up the forest clad hillside, and once or twice the familiar Asiatic Cuckoo (*Cuculus canorus telephonus*) reminded me of its presence. In the evening one of the latter actually came down to my camp for a few minutes. I had two Himalayan Jungle Crows' (*Corvus coronoides intermedius*) nests within a couple of hundred yards of me, one of which was not more than fifteen or twenty feet up in a slender pine, and I was quite pleased to see these black bullies and arrant egg-stealers being thoroughly mobbed by a pair of ferocious Himalayan Black Drongos (*Dicrurus macrocercus albirictus*), which, judging by their aggressiveness, most probably had a nest in the vicinity, though I was unable to spot it.

An Indian Hoopoe (*Upupa epops orientalis*) was frequently visiting the patch of grass on which my tent was pitched, and flying off with the grubs he extracted therefrom to a wall about a hundred yards away, over which he disappeared at exactly the same spot on every occasion. I thought that there must be a nest in the base of the wall on the far side, but it turned out to be in a hollow trunk just beyond. There was a small entrance hole about two feet from the ground, and facing the wall, and from this were emitted loud squeaks at each visit of the parent bird. That evening I built a small sangar only four feet from the tree, using the stones of the wall for this purpose.

Next morning, when I awoke, it was raining hard and so dark that it was obvious that photography was out of the question. However I had made arrangements to set off for the boat at midday and did not want to alter my plans, as I had already fixed everything up for a lengthy trip into the Lolab, which, as it happened, I never completed, as I went down with a bad dose of fever. I therefore had myself roofed into the 'hide ', setting up the



JERDON'S LITTLE RINGED-PLOVER

(*Charadrius dubius jerdoni*)

camera in case it cleared, but mainly with the idea of noting the behaviour of the birds.

The proximity of the 'hide' and the round black patch of the shutter impressed the Hoopoe so little, that he arrived the moment I was left alone. He did not enter the nest however, the food being taken from him at the entrance, but whether by a young one or the female I could not ascertain.

However after his third or fourth visit a fully-fledged young one poked its head out of the hole, and for about half a minute surveyed the outer world. Then a few moments later a bird flew out, too quickly for me to be able to see whether it was an adult or one of the young ones, but I rather think it must have been the female, as a few minutes later both adult birds appeared on the scene, and one of them immediately went in, the other flying away again after first transferring a grub to the birds inside. After this the old procedure was restarted. It looks therefore as if the male did all the grub hunting, while the female superintended the feeding of the youngsters within. This is not always the case however, as last April while on parade I noticed a nest high up in a crevice in a banyan tree. On this occasion both birds were equally industrious in hunting for their offsprings' food, and in twenty minutes between them they visited the nest no less than twenty-one times, after which they rested from their labours. There was no transferring of food from one adult to the other, but both entered the nest irrespective of the other's whereabouts. Judging from their antics, their chief prey appeared to be small grey grasshoppers which abounded on the sandy parade ground.

As the weather had not cleared by about ten o'clock, and it was, if anything, darker still, I decided to push off, but exposed two plates giving as long an exposure as the movements of the bird would permit, but, as I expected, they were so underexposed as to be practically useless. Incidentally the bird took not the slightest notice of the snap of the shutter.

Thus ended my first experiences in the use of a 'hide'. I cannot say the camera results were very satisfactory, but I certainly learnt a lot, and in consequence have since been more successful. Of the many lessons I imbibed, two stand out well above the others. The first that far longer exposures are required than one would ever suspect, so in order to cut them down as much as possible one should use the largest stop one can afford to: the other, that, in the case of a sitting bird at any rate and provided one is careful, one can give exposures of considerable length without undue risk of getting a moved image, as, even if the bird is startled, it seems to take quite an appreciable time before its brain can communicate with its muscles so to speak and put it in motion. In bird-photography, when the subject is close to the camera, one has to remember that the long bellows extension makes an appreciable difference in the length of the exposure required. In talking of the near proximity of the subject to be photographed it also behoves me to mention here that one can make a great mistake by trying to approach too close up. There are distinct limits, which are not only bounded by the fact that the nearer the 'hide' the shyer the subject is likely to be. It is far better to get a small but entirely sharp image which can subsequently be enlarged to almost any degree, than to get a large image half of which will probably be out of focus owing to the fact that to stop down the lens to get the necessary depth of focus will unduly prolong the exposure beyond the bird's capacity for stillness. Another point of considerable importance is that most birds undoubtedly fear the bright lens, probably mistaking it for the eye of some outlandish animal, so as it often cannot be done away with by having the shutter in front of it, it should certainly be shaded as much as possible. Lastly, it is obvious that birds very rapidly become used to noises from inside the hide, so, once the bird has shown itself to be used to the noise of the shutter, one may not be too fearful of the sounds one is bound to make at times changing plates, and so forth. This fact really should be quite patent to any one. Trees and bushes are for ever creaking and rustling in a breeze, and if every bird left its nest in a panic at the slightest noise in its vicinity, it would indeed have a thin time of it.

Just before I reached the boat, I saw a Tickell's Thrush (*Turdus unicolor*) carrying material to a nest it was building in a willow close to the path. It was obtaining its material from an old nest in another tree about 50 yards away. I also noticed an Indian Oriole (*Oriolus oriolus kundoo*) building almost at the very top of an enormous chenar, and a Rufous-backed Shrike sitting on a nest on a branch overhanging the path.

NOTES ON SNAKES COLLECTED IN BURMA IN 1924

BY

COLONEL F. WALL, C.M.G., K.H.S.

In response to an appeal to various residents in Burma I obtained 323 snakes during 1924, representing 57 species. These include four new to Science, viz., *Natrix bitæniata*, *Natrix gilhodesi*, *Natrix nigriventer*, and *Natrix clerki*; a new colour variety of *Calliophis macclellandi*, viz.—*concolor*; further the collection adds to the list of the Burmese anguifauna four more species, viz.—*Natrix nuchalis*, previously known from China, *Rhabdops bicolor*, *Nerodia modesta* and *Ptyas nigromarginatus* previously known from Assam.

I take this opportunity of thanking those who have assisted me in advancing our knowledge of the fauna of this province. The Rev. Father Gilhodes rendered signal service in procuring 104 specimens from the Kachin Hills, an area little exploited, and his material has been specially interesting as the fauna so closely approximates to that of the Western Chinese hills. He has been responsible for adding two species new to Science. Mr. Clerk also worked for me in the Kachin Hills, and obtained one new species and many specimens that had previously been considered very rare. Mr. P. M. R. Leonard procured many very valuable specimens from the Northern Shan States, including one new species. Major Rodrigues acquired many interesting specimens in the Southern Shan States. Working as he did in a locality that had been previously exploited by the late Colonel Bingham, it was hardly to be expected that he would find a new species. His material however was valuable in confirming and amplifying the work of his notable predecessor. Captain Treston, I.M.S., succeeded in throwing much light on the local species at Myitkyina. Captain Wilkinson and Assistant Surgeon O'Reilly contributed to our knowledge of the snakes in and about Mandalay.

Names of localities are spelt in accordance with the latest maps of the Geological Survey of India.

Family—TYPHLOPIDÆ

Typhlops diardi Schlegel

Fourteen examples of this common snake were acquired, all of which were quite typical except one large adult twelve inches long, which was a uniform pale grey in colour. As far as I could judge this was not due to impending desquamation. I referred to a similar variety from Assam in my paper on this snake in this Journal (vol. xxv, p. 381) and proposed the name *cinereus* for it.

Dr. Malcolm-Smith (Jour. Nat. Hist. Soc. Siam., vol. 6, p. 53) suggests that *T. tephrosoma*, a similarly coloured snake described by me from the Khasi Hills, Assam, should be regarded as *T. diardi* as he has found typical *diardi* in Siam with 28 scale rows. This view is probably correct.

FOES. Two specimens measuring 96 and 288 mm. (3⅞ and 11½ inches) were recovered from the stomach of a Macclelland's coral snake (*Calliophis macclellandi*).

BREEDING. (a) *Genitalia*. One male specimen had the claspers extruded. These organs are duplicated as in other snakes. Each clasper is cylindrical, with a 'raphé' running from behind outwards to the tip, which is swollen and thrown into folds like a rosette. There are no recurved processes such as one sees in Colubrine and Viperine species.

(b) *Season*. Three females measuring 275, 305 and 342 mm. (11, 12 and 13½ inches) were egg-bound. The first killed on the 10th of June contained 7 eggs, the second killed on the 30th of June showed 3 follicles obviously impregnated, and the third killed in July contained 8 eggs.

GROWTH. One female was exceptionally large measuring 417 mm. (1 foot, 4½ inches).

DISTRIBUTION. This species which is so common in the plains of Burma as far north as Fort Hertz, Putao District, occurs up to over 5,000 feet. Eight specimens were sent to me from Huton in the Kachin Hills (4500 feet). Venning obtained it in the Chin Hills at Minkin (5,600 feet). Also taken at Taunggyi, Southern Shan States (5,000 feet).

Family—BOIDÆ

Sub-family—PYTHONINÆ

Python molurus (Linné)

One small female (?) specimen came in from Myitkyina, measuring 915 mm. (3 feet), the tail 112 mm. (4½ inches). This was killed between the 1st and 24th of June. The ventrals numbered 259 and subcaudals 68 of which the last 8 were entire.

DISTRIBUTION. Probably occurs throughout Burma. Localities actually known to me are Arakan (near Akyab); Pegu District (Pyinbongyi); Magwe District (Minhla); Myitkyina; Tennasserim District (Tavoy); North Shan States (Maymyo).

Family—ILYSIIDÆ

Cylindrophis rufus (Laurenti)

Two specimens were sent in from Bhamo, and Mandalay. A freshly-killed specimen was black with an ultramarine fluorescence in reflected light. The dorsal bars were faint orange anteriorly and deep orange posteriorly. The anal region was bright canary, and the tail brilliant orange beneath. One of these was killed in a house at night.

The eye in life is completely black so that the shape of the pupil is not visible.

DISTRIBUTION. An uncommon species occurring in the basin of the Irrawaddy from Bhamo to Ava and its tributary the Tsamon river (Pyawbwe); the Pegu river (Pegu); the Sinthe river (Pyinmana) and in the Tenasserim District. It occurs also in the hills up to about 5,000 feet. North Shan Hills (Maymyo); South Shan Hills (Taunggyi).

Family—XENOPELTIDÆ

Xenopeltis unicolor Reinwardt

All the thirteen specimens received came from Myitkyina, all collected between the 1st of June and 15th of November.

FOOD. Two had recently fed. One of these contained two full grown munias (*Uroloncha punctulata*) and the other the remains of what appeared to be a callow young shrew.

BREEDING. None showed any evidences of impregnation.

GROWTH. Two young killed between the 24th of August and the 15th of November measured 317 and 342 mm. (12⅝ and 13⅝ inches). The largest specimen was a female which taped 818 mm. (2 feet 8¼ inches).

LEPIDOSIS. The ventrals ranged from 182 to 189 and the subcaudals from 24 to 25.

DISTRIBUTION. It appears to be restricted to the basin of the Irrawaddy from Myitkyina southwards, and to river basins further east. Has been recorded from Myitkyina, Ava, Tharawaddy, Prome, Pegu, Rangoon, Bassein, Tenasserim District (Tavoy, Mergui).

Family—COLUBRIDÆ

Polyodontophis collaris (Gray)

Five specimens from the Kachin Hills (Huton 4,500 feet). Three of these contained skinks (*Lygosomata* ?) in the stomach.

Natrix bitæniata sp. nov.

A small snake sent to me by Mr. P. M. R. Leonard from Kutkai, North Shan States (4,500 feet) which I at first took to be a specimen of *Rhabdophis parallelus* Boulenger, proves to be a very distinct species. I prepared the skull of a similar specimen from Sinlum Kaba, Kachin Hills (6,000 feet), and find that the maxillary dentition is syncranterian, whereas in *parallelus* from the Khasi Hills, Assam the dentition is diacranterian. An examination of all the specimens, identified as *parallelus* in the Bombay collection and the Indian Museum, shows that those collected in the Eastern Himalayas and the Assam Hills agree with *parallelus* in dentition, whereas the specimens from Burma (Kachin Hills and North Shan Hills) and all those collected by Anderson in the Yunnan Expedition of 1868, conform to the type of *bitæniata*. Reference to Boulenger's Catalogue (vol. i, page 223), shows the author based his description of *parallelus* on six specimens from Sikkim, the Khasi Hills, Sanda on the upper Irrawady (1,500 feet; Lat. 24° ·30, Long ·95°), and the Hotha Valley, Yunnan, the two latter specimens being collected by Anderson during the Yunnan Expedition. It seems probable that the two last will be found to conform with *bitæniata*, and that the remaining four only should be retained as types of *parallelus*. For many years I have been puzzled to know why Boulenger placed *parallelus* in the subgenus *Tropidonotus* (=*Natrix*), as my skulls from Khasi Hill and Sikkim specimens show the maxillary dentition to be diacranterian and conforming to the dentition of the genus *Rhabdophis*. The explanation seems to be that when examining the dentition he had before him one of Anderson's specimens.

I have now seen ten specimens of *bitæniata*, seven of which are Anderson's Yunnan examples in the Indian Museum. I have notes on eighteen specimens of *parallelus* from the Eastern Himalayas, and Assam Hills.

I have critically examined, side by side, Anderson's seven examples with several specimens of *parallelus* from the Eastern Himalayas, and the Assam Hills. They are surprisingly alike. I can find no constant character in the lepidosis to distinguish one from the other, and the few differences in markings are trivial. Were it not for the marked difference in the maxillary dentition, nobody would suppose them different.

The differences noted by me are :—(1) In *parallelus* there is a dark præocular streak sometimes extending to the rostral. There is no such streak in *bitæniata*. (2) The postocular streak in *parallelus* is not so broad, or so well defined as in *bitæniata*, and is interrupted at the gape, i.e., not connected with the lateral black body stripe. In *bitæniata* the postocular stripe is continuous with the lateral body stripe. (3) In *parallelus* the blackish lateral body stripe on the 3rd and 4th rows above the ventrals, is not so well defined or conspicuous as in *bitaeniata*. As regards lepidosis, in *parallelus* the anterior temporal shields are usually single, in *bitæniata* usually two.

LEPIDOSIS. *Rostral*, just visible above, depth about three-fifths the breadth. *Internasals*, a pair, truncate anteriorly; the suture between them subsequal to that between the praefrontals. *Praefrontals*, a pair; the suture between them about two-fifths the length of the frontal. *Frontal*, greater than its distance to the end of the snout; breadth, a shade more than twice that of the supraocular at mid orbit. *Loreal*, one. *Praeocular*, one. *Postoculars*, three. *Temporals* 2+1. *Supralabials*, 8; the 1st and 2nd touching the nasals, 3rd, 4th and 5th the eye; 6th and 7th the lower temporals. *Posterior Sublinguals*, rather longer than the anterior; divergent posteriorly; touching the 5th, 6th and 7th infralabials; partially separated by two small azygos scales and one pair, after which is a narrow 1st ventral. *Costals*, two heads-lengths behind the head 19, midbody 19, two heads-lengths before the vent 17. Keeled to the penultimate row in mid body. Emarginate apically. No. (?) apical facets. *Ventrals*, 164. *Anal*, divided. *Subcaudals*, 86 pairs.

In a ♂ from Sinlum Kaba the anterior temporals are single, ventrals 172, and subcaudals 92. In another from Sinlum Kaba the anterior temporal is single, the 4th and 5th infralabials only touch the eye, the ventrals are 160 and subcaudals 83.

DENTITION.[1] *Maxilla*, 23 teeth; syncranterian, anododont, coryphodont. *Palatine*, 17; feebly kumatodont. *Pterygoid*, 30 to 34; feebly scaphiodont. *Mandibular*, 28 to 29; anododont, feebly kumatodont.

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[1] The teeth in three skulls of *Rhabdophis parallelus* in my collection from Sikkim are as follows:—*Maxilla*, 18 to 21; diacranterian. The cranterian teeth not twice the length of the preceding. *Palatine*, 14 to 16. *Pterygoid*, 20 to 26. *Mandibular*, 24 to 27.

DISTRIBUTION. *Burma* North Shan Hills (Kutkai) ; Kachin Hills (Sinlum Kaba); Upper Chindwin (Sanda). *China.* Yunnan.

Natrix gihodesi [1] Wall

Nineteen specimens of this snake, recently described by me in this Journal (vol. xxx, p. 587) were sent to me by the Revd. Father Gilhodes from Huton, Kachin Hills.

LENGTH. The largest specimen proved to be a female 486 mm. (1 foot 10¾ inches), tail 182 mm. (7¼ inches).

LEPIDOSIS. *Praeoculars*, five specimens had two on each side. *Postoculars*. There were two only on the left side in one specimen and two on both sides in another. *Supralabials*, the 4th and 5th were confluent in one specimen making a total of 8, the 4th and 5th only touching the eye. *Ventrals*, 146 to 157. *Subcaudals*, 92 to 108. The 2nd entire in one specimen.

FOOD. One contained a frog in the stomach.

BREEDING. Three examples proved to be egg-bound, the eggs being of such a size as to make it fairly certain that the species is oviparous. One killed in June contained one elongate egg, 31 mm. (1¼ inch) in length. One killed between July and October contained two eggs, and one killed between October and December two eggs, 26 to 28 mm. long (1 to 1⅛ inch). The smallest dam taped 434 mm. (1 foot 4¾ inches). It would appear from the growth of specimens given below that the species is sexually mature when two years old.

GROWTH. In the months October to December one specimen 218 mm. (8¾ inches) long was killed which is obviously this year's production. Four others ranging between 380 and 442 mm. (15 and 17½ inches) represent young of 1923, showing that the species about doubles its length in the first year of life. Another specimen 575 mm. (1 foot 10¾ inches) in length, probably represents one hatched in the year 1922.

DENTITION. From one skull in my collection. *Maxilla*, 26 teeth ; syncranterian, anododont, coryphodont ; the last 3 teeth enlarged but not twice the length of the preceding. *Palatine*, 14 to 16 ; anododont, isodont. *Pterygoid*, 25 to 27 ; anododont, feebly scaphiodont ; the teeth except posteriorly about the same size as the palatine, *Mandibular*, 28 to 30 ; anododont feebly kumatodont.

Natrix nuchalis (Boulenger)

I described, as a new species in this Journal, a snake under the name of *N. leonardi* (Journ. B. N. H. S., vol. xxix, p. 466). Mr. Parker writes to me from the British Museum that he has compared this with the type of *N. nuchalis*, and several other specimens of the latter from the Tonkin Hills in China, and thinks that my *leonardi* cannot be separated from Boulenger's *nuchalis*.

LEPIDOSIS. I received one specimen from Sinlum Kaba, Kachin Hills, which differed from my type of *N. leonardi* in having the scale rows 19 two heads-lengths behind the head, 17 in midbody, and 15 two heads-lengths before the vent, as compared with the type where the rows numbered 17, 17 and 15. Miss Procter who preceded Mr. Parker examined my type of *N. leonardi* and while remarking on its affinities to *nuchalis* noted that the scales in my *leonardi* are strongly keeled, whereas in *nuchalis* they are feebly keeled. Mr. Parker found in some of the Tonkin specimens alluded to, the scale rows numbered 19, 17, 15. There appears therefore to be no doubt that my *leonardi* cannot be retained as a species distinct from *nuchalis*. The ventrals in my specimen number 149, and the subcaudals 48. It has two postoculars and two anterior temporals on the left side. The supralabials are 6. The 5th is a very long shield which appears to be a confluence of two. However this is a constant feature, not an aberrant one, as surmised in my original description, where I recorded these shields as 7. It is a female measuring 580 mm. (1 foot 11 inches) the tail 112 mm. (4½ inches).

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[1] Mr. Parker writing to me from the British Museum doubts whether this species is entitled to rank as such, distinct from *N. khasiensis*. However there can be no doubt in my mind. I have one skull of *khasiensis* from Shillong, Khasi Hills. The maxilla holds 22 to 23 teeth, the palatine 16, the pterygoid 25 to 26, and the mandibular 31 to 32.

DISTRIBUTION. A local hill snake which appears to be confined to an altitude above about 5,000 feet since no specimen was included among the 104 snakes received from Huton (4,500 feet) in the same Hills.

Natrix clerki sp. nov.

A single specimen of a snake which I consider deserves specific rank as a new *Natrix*, was sent to me by Mr. Clerk from Sinlum Kaba, Kachin Hills.

This is a ♂ measuring 565 mm. (1 foot 10⅝ inches), the tail 170 mm. (6¾ inches.)

LEPIDOSIS. *Rostral*, just visible above. *Internasals*, a pair; the suture between them equal to that between the praefrontal fellows; truncate anteriorly. *Praefrontals*, a pair. *Frontal*, length greater than its distance to the end of the snout. *Loreal*, one. *Praeocular*, one. *Postoculars*, three. *Temporals*, 1 + 2. *Supralabials*, 8; the 1st and 2nd touching the nasals, 3rd, 4th and 5th the eye, and the 6th and 7th the anterior temporal. *Posterior Sublinguals*, rather longer than the anterior; divergent posteriorly; touching the 4th and 5th infralabials. Separated posteriorly by one azygos and a pair of scales and succeeded by a narrow first ventral. *Costals*, two heads-lengths behind the head 19, midbody 19, two heads-lengths before the vent 17. Keeled to the last row in midbody. Emarginate apically, No. (?) apical facets. *Ventrals*, 175. *Anal*, divided. *Subcaudals*, 106; divided.

COLOURATION. Blackish-olivaceous dorsally to the edges of the ventrals. A series of ill-defined light roundish spots on the 5th row above the ventrals and the adjacent halves of the 4th and 6th rows, continued to the base of the tail. Belly yellowish anteriorly, merging to pale salmon posteriorly, suffused more deeply laterally; with an occasional small dark round spot on the edges of the ventrals. Head blackish-olivaceous. A short mesial light streak just behind the parietals. A light well-defined V on the nape beginning behind the gape. First 5 supralabials with black posterior borders A black postocular stripe to the sides of the neck. Chin immaculate.

Nerodia piscator. (Schneider)

Thirty-three specimens from Myitkyina, Mandalay, Maymyo and Huton. The usual variety is one with large black spots. Olive specimens with a light chequering were received from Maymyo and Huton.

Nerodia modesta ? (Günther)

I received one specimen of a snake I refer with some doubt to this species.

LEPIDOSIS. *Internasals*, narrowed anteriorly. *Loreal*, present. *Praeoculars*, two. *Postoculars*, three. *Temporal*, one anterior. *Supralabials*, 9; the 1st and 2nd touching the nasals, 4th, 5th and 6th the eye, and the 7th and 8th the anterior temporal. *Costals*, 19 two heads-lengths behind the head, 19 in midbody, 17 two heads-lengths before the vent. Keeled to the penultimate row in midbody. *Ventrals*, 147. *Anal*, divided. *Subcaudals*, 84 (tail broken), divided.

COLOURATION. Darkish brown. A dorsal yellowish ill-defined lateral stripe on the 5th and 6th rows above the ventrals, with lighter spots incorporated. A series of blackish ill-defined spots below the light stripe and a less distinct series of blackish spots above the light stripe. Belly yellow with a squarish black spot near the edge of each ventral, forming a stripe from throat to tail tip. Head dark brown with pale vermiculations, and a pair of pale spots, one on each side of the interparietal suture. Supra and infralabials with blackish sutures. An ill-defined short yellowish temporal streak to the side of the neck.

LENGTH. 310 mm. (1 foot and ⅛ of an inch), tail, broken; 87 mm. (3½ inches.)

HABITAT. Huton, Kachin Hills. This adds another species to the Burmese anguifauna.

DENTITION. *Maxilla*, supports dubiously 28 teeth, anododont, syncranterian, coryphodont. (In my only skull of *modesta* from Cherrapunji, Khasi Hills, Assam, the maxillary teeth number 22.)

Rhabdophis stolatus (Linné)

Twenty-two specimens from Myitkyina, Bhamo, Mandalay, Rangoon, Maymyo, Kutkai and Huton.

All the specimens from Maymyo were of the vermilion variety, and several of those from Mandalay, and Bhamo.

Habits. One was killed at Bhamo in a bungalow at night.

Food. A frog found in the stomach of one.

Breeding. One egg-bound ♀ from Mandalay killed in August or September contained 5 eggs about 25 mm. (one inch) long. Mrs. Swithinbank found eggs in her garden in Rangoon which hatched out about three weeks later. On September 27 one broke its shell at 10-15 a.m. another at 1-15 p.m. a third at 2-10 p.m. and a fourth at 2-20 p.m. The first left its egg at 4 p.m. but the rest remained within their eggs, being found outside them on the following morning.

Rhabdophis subminiatus (Schlegel)

Twenty specimens from Huton, Kachin Hills; Kutkai, Tawongnga, and Maymyo in the North Shan States, Taunggyi in the South Shan States, and Maungdaw near Akyab.

Habits. Two of these were captured alive. They erected themselves and flattened the fore body making a great demonstration of anger, but refused to bite on provocation.

Distribution. This common species is universally distributed in Burma. It is a somewhat uncommon snake in the plains, but a common one in the Hills up to 6,500 feet. Blyth records it from Arakan. I have records from Maungdaw on the coast above Akyabe and Myitkyina; Tharawaddy District (Rangoon). Pegu District (Pegu, Tadungu); Thaton District (Thaton, Shwegun); Amherst District (Kawkareik); Kachin Hills (Huton); Chin Hills (Haka); Pegu Yomas (Hinyachaung); North Shan Hills (Maymyo, Kutkai, Tawongnga), South Shan Hills (Taunggyi).

Rhabdops bicolor (Blyth)

A single adult specimen was sent to me from Huton, Kachin Hills. This adds another snake to the Burmese anguifauna. It was previously only known from the Khasi Hills in Assam, and from Yunnan.

Colouration. The specimen, a recently killed one, is olivaceous-green dorsally, to the edges of the ventrals. The scales are narrowly edged with black, forming interrupted linear stripes except on the two lowest rows where the black, is modified to a mottling. The belly is uniform canary yellow. The head is olivaceous, this hue extending beneath the chin, and becoming a mottling on the posterior sublingual shields.

Lepidosis. The ventrals number 188, and the subcaudals 57 (the tip of the tail slightly deficient). The lateral scales in the anal region are not tuberculate.

Distribution. This is a hill snake living at an altitude above about 4,000 feet. Only recorded in Burma from the Kachin Hills.

Plagiopholis blakewayi Boulenger

Nine specimens 6♂ and 3♀ were received from Sinlum Kaba, Kachin Hills.

Colouration. The dorsal colour varies considerably. Some specimens are a blackish brown, others a rich lustrous terracotta. Many of the scales are edged with black, others in the flanks have their lower borders, where overlapped, white, or salmon-pink, in the ruddy specimens. A black zig zag line borders the ventrals. The belly is dirty yellowish in the dark specimens, and dull salmon in the ruddy examples. A sparse and irregular mottling of fine black spots, very variable in extent, is seen on the belly. A more or less conspicuous black arrow head on the nape. Ruddy spirit specimens when skinned are found to have tinged the tissues a salmon-pink.

Lepidosis. There are several notable features in the scaling of this species. *Supralabials*, number 5 only, of which the 1st and 2nd touch the nasals, the 3rd the eye, and the 4th or 4th and 5th the anterior temporal. *Loreal*, absent except in one specimen. *Posterior temporal*, a single shield. *Infralabials*, the 1st do not touch, so that the mental forms a considerable suture with the anterior sublinguals. *Costals,* in 15 rows in the whole length of the snake. The lateral scales in the anal region of males are strongly keeled, in their anterior halves, as one sees in males of the genus *Aspidura.*

Ventrals, ♂ from 126 to 130, ♀ from 126 to 132. *Anal,* entire. *Subcaudals,* ♂ 23 to 27, ♀ 21.

Length. The longest ♂ measured 398 mm. (1 foot, 3¾ inches) ; the longest ♀ 362 mm. (1 foot, 2¼ inches.)

Food. One that had recently fed contained an earth worm in the stomach, and this explains the semi-liquid mud found in the intestines of other specimens.

Growth. One juvenile specimen taped 127 mm. (6 inches.)

Dentition. From two skulls in my collection. *Maxilla,* 18 to 20 teeth ; anododont, syncranterian, feebly kumatadont. *Palatine,* 15 to 20 ; anododont, isodont. *Pterygoid,* 21 to 23 ; anododont, isodont. *Mandibular,* 25 to 26 ; anododont, scaphiodont.

Distribution. The fact that so many specimens were obtained at Sinlum Kaba at an altitude of 6,500 feet, while none came in from Huton (4,500 feet) in the same hills out of one hundred and four specimens seems to indicate that it is confined to what one may call an Alpine elevation. The type and another examined by me were obtained at Taunggyi in the South Shan Hills (5,000 feet).

Trirhinopholis nuchalis Boulenger

Thirteen specimens were sent in, eleven from Huton, Kachin Hills ; and two from Kutkai, North Shan Hills.

Colouration. These specimens vary in their prevailing colour very much as does the last species. Some are blackish brown dorsally, others of a ruddy brown tinge. Many of the scales are edged with black, and many have white or pinkish yellow edges which overlapped, producing a variegation. The belly is yellowish-salmon finely peppered with black spots. There is also a lateral series of irregularly distributed squarish or oblong black spots. The head is olivaceous-black to the edge of the lip. A conspicuous black arrow head on the nape, its apex reaching the tip of the parietal shields. Some of the infralabial sutures black.

Lepidosis. *Loreal,* present, *Supralabials,* 6 ; the 1st and 2nd touching the nasals, 3rd and 4th the eye, and the 5th the anterior temporal. The 5th is an unusually large shield. *Posterior temporals,* 2. *Infralabials,* the 1st do not meet, so that the mental forms a considerable suture with the anterior sublinguals. *Costals,* in 15 rows in the whole body length. The lateral scales in the anal region of males are keeled as in the last species. *Ventrals,* ♂ 127 to 131, ♀ 138 to 141. *Anal,* entire. *Subcaudals,* ♂ 23 to 29, ♀ 22 to 27. 2nd and 3rd entire in two examples, 2nd, 3rd, and 4th in one.

Length. The largest ♂ measured 474 mm. (1 foot 6⅝ inches), and the largest ♀ 293 mm. (11½ inches).

Food. Many specimens had recently fed and all contained earthworms in the stomach, and much semi-liquid mud in the intestines.

Dentition. From three skulls in my collection. *Maxilla,* 19 to 23 (24 ?) teeth ; anododont, syncranterian, feebly kumatodont, *Palatine,* 15 to 19 ; anododont, feebly scaphiodont. *Pterygoid,* 21 to 29 ; anododont, scaphiodont. *Mandibular,* 24 to 27 ; anododont, feebly kumatodont.

Distribution. It has usually been recorded from hills about 4,000 feet and over East of the Chindwin in the North, and East of the Tsamon and Sittang rivers further South. Foot hills in Katha District (Mansi) ; Kachin Hills (Huton, Sima, Sinlum Kaba) ; Ruby Mines District (Mogok) ; North Shan Hills (Kutkai) ; South Shan Hills (Taunggyi) ; Hills in Toungoo District (Thaudaung 3,500 feet) ; Karen Hills, exact locality not recorded, but probably from a range between the Salween river and its tributary the Pawn which averages 4,000 feet. It will almost certainly be discovered in the Tenasserim Hills as Malcolm-Smith records it from Ratchaburi, two miles east of the Tenasserim border.

Lycodon aulicus (Linné)

Twenty specimens from Mandalay, Myitkyina and Rangoon.

Breeding. Two females 412 and 480 mm. (1 foot, 4¼ and 1 foot, 7 inches) killed in Mandalay between August and October were egg-bound and contained 3 eggs each.

Lycodon fasciatus (Anderson).

Ten specimens from Maymyo, Kutkai, Taunggyi, and Huton.

LEPIDOSIS. *Ventrals*, these range between 203 and 215. *Subcaudals*, 78 to 85.

FOOD. One had swallowed a skink, and another contained the tail of a lizard (skink ?) in the stomach.

DENTITION. From four skulls in my collection. *Maxilla*, carries 9 to 11 teeth ; oinododont, diacranterian, anisodont. The first 4 teeth progressively increase, the 5th is equal to the 4th, and is followed by a short edentulous space. The praecranterian series number 2 to 3, and are isodont. Cranterian 2, subequal and larger than the praecranterian. *Palatine*, 13 to 15 ; anododont, isodont. *Pterygoid*, 19 to 29 ; anododont, scaphiodont. *Mandibular*, 15 to 17 ; oinododont, anisodont. The first 4 or 5 progressively increase in size, the 5th (4th) is as long as the 4th (3rd) and succeeded by a short edentulous space. The postnodal number 10 to 12, and are scaphiodont. This species connects the genus *Lycodon* with *Dinodon*. It agrees with other *Lycodons* in having 2 instead of 3 cranterian teeth but it resembles *Dinodon* in having 6 to 7 praenodal teeth instead of 4 to 5. The praecranterian series resemble those of *Dinodon* in numbering 2 or 3 instead of from 4 to 12 as in other species of *Lycodon*.

DISTRIBUTION. It is a hill snake occurring at an altitude above 3,000 feet. Katha District (Mansi) ; Kachin Hills (Sima, Huton) ; Chin Hills (Haka) ; Ruby Mines District (Mogok) ; North Shan Hills (Maymyo, Kutkai) ; South Shan Hills (Taunggyi).

Ptyas nigromarginatus (Blyth)

One specimen was obtained at Huton, Kachin Hills. This species adds another to the Burmese anguifauna. It was previously known from the Eastern Himalayas, Assam Hills and Yunnan.

The specimen was a small one measuring 348 mm. (1 foot, 1¾ inches).

Ptyas mucosus (Linné)

Only four specimens were sent in from Mandalay and Maymyo. This is due to the fact that I asked various collectors to send in nothing more than a yard long.

Zamenis korros (Schlegel)

One juvenile female specimen was sent in from Huton, Kachin Hills, measuring 368 mm. (1 foot, 2½ inches).

LEPIDOSIS. *Ventrals*, 191, *Subcaudals*, 139.

Coluber prasinus Blyth.

Five examples were received from Huton, Kachin Hills.

LEPIDOSIS. *Ventrals*, 197 to 209. *Subcaudals*, 105 to 111.

GROWTH. One, apparently a hatchling with patent umbilicus, killed between July and October measured 315 mm. (1 foot, ⅜ of an inch). Another killed between October and December measured 334 mm. (1 foot, 1⅛ inch).

ECTOZOA. The hatchling was infested with scarlet mites (*Microtrombidia* ?) attached between the costals and ventrals.

DISTRIBUTION. This is a hill species occurring above about 4,000 feet. Recorded from Putao District (Gauri, Lat. 27°·31, Long. 97°·46); Katha District (Mansi) ; Kachin Hills (Huton) ; Ruby Mines District (Mogok) ; South Shan Hills (Taunggyi) ; Chin Hills (Haka).

Coluber porphyraceus Cantor

Five examples came in from Sinlum Kaba, Kutkai, Maymyo and Taunggyi.

DISTRIBUTION. A hill snake occurring usually above about 3,000 feet. Recorded from Chin Hills (Haka, Tiddin, Falam) ; Manipur ; Katha District (Junction of the Mu and Kodan tributaries of the Chindwin) ; Kachin Hills (Sinlum Kaba) ; Ruby Mines District (Mogok) ; North Shan Hills (Kutkai, Maymyo) ; South Shan Hills (Taunggyi, Pwehla, Loilem) ; East of Salween river.

Coluber radiatus Schlegel

Five specimens from Huton, Mandalay, and Taunggyi.

Growth. A young specimen 368 mm. (1 foot, 2½ inches) was killed in Mandalay between September and November, and another 398 (1 foot, 3¾ inches) at Huton between October and December.

Distribution. This is a common species throughout Burma in the plains, and ascends the hills up to about 5,000 feet.

Coluber leonardi Wall.

Two fine specimens were sent in from Sinlum Kaba.

Length. One specimen measured 780 mm. (2 feet, 6¾ inches), the tail 118 mm. (4¾ inches).

Lepidosis. *Praefrontal.* Confluent with the praeocular on the right side in one example. *Loreal*, wanting as in the type. *Ventrals*, 208 and 225. *Subcaudals*, 53 and 51.

Dentition. From one skull in my collection. *Maxilla*, carries 16 to 17 teeth; anododont, syncranterian, feebly kumatodont. *Palatine*, 10; anododont, feebly kumatodont. *Pterygoid*, 12 to 13; anododont, scaphiodont. The low number of teeth is unusual in Indian species of this genus. *Oxycephalus*, has 12, *cantoris*, *hodgsoni*, *helena*, *melanurus*, *porphyraceus*, *prasinus*, *radiatus*, and *tæniurus* have from 15 to 30 teeth. *Mandibular*, 21; anododont, scaphiodont.

Vertebræ. As in other Indian species of the genus, the hypapophyses disappear in the second eighth of the body.

Distribution. Has only been found in Burma in the Kachin Hills (Sinlum Kaba, whence I have seen four examples). There is a specimen in the Bombay collection from Assam exact locality not on record.

Dendrophis pictus (Gmelin)

Four specimens from Huton, Kachin Hills and Hsen-wi, North Shan States. This is a fairly common snake in Burma, occurring throughout the plains, and up to an elevation of about 4,500 feet.

Dendrelaphis subocularis (Boulenger)

One ♂ specimen from Huton.

Length. 805 mm. (2 feet, 7¾ inches), the tail 232 mm. (9¼ inches).

Lepidosis. *Ventrals*, 168. *Anal*, divided. *Subcaudals*, 103.

Dentition. From two skulls in my collection. *Maxilla*, carries 16 to 18 teeth; anododont, syncranterian, kumatodont. *Palatine*, 11 to 13; anododont, feebly scaphiodont. *Pterygoid*, 18 to 22; anododont, scaphiodont. *Mandibular*, 17; anododont, kumatodont.

Distribution. Has only once before been recorded from Burma, viz., from Bhamo. This record probably means Bhamo District, and the specimen is probably from the Kachin Hills.

Oligodon herberti Boulenger

Two fine examples from Huton, both females.

Length. 490 mm. (1 foot, 11⅜ inches). The tail 65 mm. (2⅝ inches).

Lepidosis. *Internasals*, absent. *Nasal*, entire. *Loreal*, absent. *Postocular*, One. *Costals*, 13 in the whole body length. *Ventrals*, 212. *Subcaudals*, 35 and 38. Not angulate.

Food. A material in the stomach of one suggests yolk of eggs, but no egg cases were found.

Breeding. One killed between July and October contained five eggs, in the oviducts, about 18 mm. (¾ of an inch) long.

Dentition. From one skull, in my collection, *Maxilla*, supports 7 teeth; anododont, syncranterian, strongly coryphodont. An edentulous space anteriorly that would take about two teeth. *Palatine*, 2 to 3; an edentulous space anteriorly. Teeth small. *Pterygoid*, completely edentulous. *Mandibular*, 9; anododont, feebly kumatodont. No edentulous space anteriorly.

Distribution. Evidently a hill snake occurring above about 4,000 feet. Recorded from Ruby Mines District (Mogok); Kachin Hills (Huton, Sinlum Kaba),

Oligodon hamptoni Boulenger

A female example from Sinlum Kaba.

Length. 486 mm. (1 foot, 7¼ inches).

Lepidosis. *Internasals*, absent. *Nasal*, entire. *Loreal*, absent. *Postoculars*, 2. *Supralabials*, 5, the 1st only touches the nasal, the 2nd and 3rd the eye, and the 4th the temporal. *Costals*, 15 in the whole body length. *Ventrals*, 175, not angulate. *Subcaudals*, 30.

Food. Two flaccid soft-shelled eggs (of lizard ?), were found in the stomach, and four empty egg cases in the upper intestine.

Dentition. From one skull in my collection. *Maxilla*, carries 8 teeth ; anododont, syncranterian, strongly coryphodont. An edentulous space anteriorly that would support 3 or 4 teeth. *Palatine*, 5 ; an edentulous space anteriorly and posteriorly. *Pterygoid*, 6 ; a long edentulous space anteriorly and posteriorly. *Mandibular*, 12 to 13 ; anododont feebly kumatodont. No edentulous space anteriorly.

Distribution. Evidently a hill species occurring above about 5,000 feet. Has been recorded from the Ruby Mines District (Mogok) ; Kachin Hills (Sinlum Kaba).

Oligodon torquatus (Boulenger)

Thirteen specimens 6 ♂ and 7 ♀ all from Myitkyina.

Length. All of these which were collected between the 1st of June, and the 15th of November ranged between 229 and 275 mm. (9⅛ and 11 inches). The largest ♂ measured 265 mm. (10⅝ inches), and the largest ♀ 275 mm. (11 inches).

Lepidosis. *Nasal*, entire. *Ventrals*, subangulate ; ♂ 149 to 157, ♀ 156 to 161. *Subcaudals*, ♂ 30 to 32, ♀ 25 to 28.

Food. One example contained a soft-shelled egg (of lizard ?) in the gullet. One contained a large brown hairy spider in the stomach which in life with legs outspread would have been probably one and a half inches across. Three contained brown crickets ' in gastro ', one of these having swallowed three. Two contained a Scolopendrum in the stomach, which Mr. Baini Pershad, Acting Director of the Indian Museum, has had identified as an *Otostigmus*, probably *rugulosus*.

Distribution. Appears to be a very local snake confined to the Valley of the Irrawaddy between Myitkyina and Bhamo. It is evidently common at Myitkyina as thirteen specimens out of fifty-five proved to be this species.

* *Oligodon violaceus* * (Cantor)

Two specimens a ♂ from Taunggyi, and a ♀ from Thandaung. The former conforms to variety *multifasciatus* (Jan.). The latter to *cinereus* (Günther).

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* I received two specimens of *Oligodon* from Thandaung, both so much alike in colouration and lepidosis (except the costal rows) as to justify some doubt as to whether the two species *violaceus* and *cyclurus*, could any longer be regarded as distinct. I presented both to the British Museum, and Mr. Parker wrote in reply ' I must confess I am somewhat uncertain as to their true nature. A comparison with the descriptions in Boulenger's Catalogue certainly leads one to believe that the specimen with 19 scale rows is *cyclurus* whilst that with 17 is *violaceus*. I have also compared the two specimens with numerous examples of both species from the collection, and find that the specimen A (19 rows) resembles *cyclurus* in all respects excepting a trifling difference in the caudals (35 instead of 37); specimen B (17 rows), however agrees more nearly with *violaceus*, differing from *cyclurus* in the number of scale rows, the shape of the loreal and parietals and the number of subcaudals. The two species appear to one to be very closely related, if they are really specifically distinct, the one apparently constant character which separates them is the number of scale rows.' I have one skull of *violaceus* from Samaguting, Assam (C 17. V 131. S 34) and four *cyclurus*, three from Burma and one from Sikkim. All have 19 scale rows. The only differences I can find in these skulls are (1) in *cyclurus* there is a short edentulous space at the back of the palatine which is not present in *violaceus*. (2) There is a short

Lepidosis. *Nasal,* divided in the ♀, semi-divided in the ♂. *Ventrals,* angulate ; 165 in the ♂, 181 in the ♀ . *Subcaudals,* 30 in the ♂, 35 in the ♀.

Food. In the Taunggyi specimen I found an unbroken snail shell about 10 mm. (⅜ of an inch) in diameter, the occupant in a much digested state.

Distribution. Occurs throughout Burma in the plains, ascending to about 5,000 feet into the hills. Recorded from Arakan Hills ; Rangoon ; Insein ; Mingladon ; Tenasserim ; Toungoo Hills (Thandaung circa 3,500 feet); North Shan States (Kunchoung) ; South Shan Hills (Taunggyi. 5,000 feet) ; Katha District (Katha. Mansi).

Oligodon theobaldi (Günther)

Twelve specimens, including 6 ♂ and 6 ♀, all from Mandalay.

Lepidosis. *Ventrals,* angulate ; ♂ 163 to 173, ♀ 169 to 177. *Subcaudals,* ♂ 39 to 41, ♀ 27 to 37.

Habits. A cat was found confronting one in a verandah at night.

Food. A much digested gecko was found in the stomach of one, and a brown cricket in the stomach of another.

Growth. One measuring 112 mm. (4½ inches) was killed between the 25th of August and the 15th of November. The largest ♂ measured 395 mm. (1 foot, 3⅝ inches). The largest ♀ was 380 mm. (1 foot, 3 inches).

Genitalia. The claspers of one were found to be cylindrical organs beset with minute recurved processes.

Breeding. Three proved to be egg-bound, one containing two, one three, and one five eggs. These were killed between August and October.

Distribution. A snake of the plains. It is an uncommon snake except at Mandalay where twelve examples were taken out of forty-eight snakes received. It seems to be restricted to the valley of the Irrawaddy, and further East from Shwebo in the North to Tenasserim in the South. Has been recorded from Shwebo ; Yeu ; Mandalay ; Myingyan. Meikila ; Minhia ; Thayetmyo ; Toungoo ; Pegu; Rangoon; Tenasserim.

Oligodon albocinctus (Cantor)

Four specimens three ♀ and one not sexed from Huton.

Lepidosis. *Ventrals,* not angulate ; 187 to 204. *Subcaudals,* 49 to 58.

Food. One contained a mouse in the stomach, one a large brown cricket and a third a flacid soft-shelled lizard's (?) egg.

Distribution. This is an uncommon snake in Burma occurring only in hills between about 2,000 and 6,000 feet. Has been recorded from Kachin Hills (Sima, Sadon, Huton) ; Chin Hills (Haka) and Arakan Hills. I have had a specimen this year (1925) from North Shan Hills (nr. Maymyo).

Oligodon purpurascens (Schlegel)

Two specimens from Maymyo, and Lashio.

Colouration. The Maymyo specimen conforms to variety (B) of Boulenger's Catalogue (vol. ii, p. 220), and is intermediate between varieties A (b) and A (c) of my paper on the genus *Oligodon*, in this Journal (vol. xxv, p. 329). The Lashio specimen accords with variety (F) of Boulenger's Catalogue and variety *O. p. maculatus* of my paper. It has twelve large, dark, bisected, dorsal spots on the body, and three on the tail. Belly immaculate.

Lepidosis. *Costals.* In the Maymyo specimen 19 ; in the Lashio 21. *Ventrals.* In the Maymyo specimen 177 ; in the Lashio 191. *Subcaudals.* In the Maymyo specimen 42 ; in the Lashio 43.

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edentulous space in the front of the pterygoid in *violaceus* which is not seen in *cyclurus*. In my paper on the genus *Oligodon* in this Journal (vol. xxv, p. 305 *et seq*) I also reported another difference (pp. 333 and 334) viz., that in *cyclurus* the parietal bone does not contribute to the orbital ring whereas in *violaceus* it does. This is a mistake, the parietal does not contribute to the orbital ring in either species.

At present the only external character which separates the two is the number of scale rows.

Distribution. This is a common species throughout the plains of Burma, and occurs in hills up to an altitude of 5,000 feet. Has been recorded from Diamond Island ; Rangoon ; Mingledon ; Pegu ; Watiya ; Shwegun ; Tenasserim Province (Moulmein, Tavoy, Mergui) Chin Hills (Haka) ; South Shan States (Kalaw, Taunggyi) ; North Shan Hills (Lashio, Maymyo), Karen Hills.

Oligodon splendidus (Günther)

One female specimen from Mandalay.

Lepidosis. *Ventrals*, 187. *Subcaudals*, 39.

Breeding. This specimen proved to be egg-bound, but the date of its capture is not on record. The eggs numbered two, and were large, measuring 35 × 12 mm. ($1\frac{3}{8} \times \frac{1}{2}$ an inch).

Dentition. From two skulls in my collection. *Maxilla*, supports 10 to 11 teeth ; anododont, syncranterian, strongly coryphodont. No edentulous space anteriorly. *Palatine*, 7 to 9 ; anododont, feebly kumatodont. No edentulous space anteriorly or posteriorly. *Pterygoid*, 8 to 15 ; anododont, feebly scaphiodont. An edentulous space anteriorly, and posteriorly. *Mandibular*, 13 to 14 ; anododont, kumatodont. No edentulous space anteriorly or posteriorly.

Distribution.[1] A snake of the plains, occupying a restricted area in the valley of the Irrawaddy between Shwebo and Pakokku, and the lower parts of its tributaries, the Chindwin, and Tsamon rivers where it is not uncommon. Recorded from Rybu Mines District (1,000 feet) ; Shwebo ; Monywa ; Sagaing ; Mandalay ; Kyaukse ; Pakokku ; Pyawbwe ; Yamethin.

Liopeltis doriæ (Boulenger)

One specimen from Huton, 295 mm. ($11\frac{3}{4}$ inches) long, the tail 57 mm. ($2\frac{1}{4}$ inches).

Lepidosis. *Costals*, in 15 rows in the whole body length. *Ventrals*, 184. *Anal*, entire. *Subcaudals*, 74. *Supralabials*, 8 ; the 3rd divided into an upper and lower part ; the upper part of the 3rd, the 4th and the 5th touching the eye.

Dentition.[2] From one rather poor skull in my collection. *Maxilla*, carries 29 to 30 teeth ; anododont, feebly kumatodont. *Palatine*, 25 to 26 ; anododont, feebly kumatodont. *Pterygoid*, 33 ? ; anododont, feebly kumatodont. *Mandibular*, 30 to 31 ; anododont, feebly kumatodont.

Distribution. Apparently a rare snake confined to hills above about 4,000 feet. Once before taken in the Kachin Hills. Recorded also from Manipur, Assam, and Yangtse Valley, China.

Liopeltis frenatus (Günther)

Two adult specimens from Huton, one ♀ and one unsexed.

Lepidosis. *Ventrals*, 152 and 158, *Subcaudals*, 96 and 98.

Dentition. From three skulls in my collection. *Maxilla*, supports 19 to 21 teeth ; anododont, isodont. *Palatine*, 12 to 14 ; anododont, isodont. *Pterygoid*, 13 to 17 ; anododont, coryphodont. *Mandibular*, 21 to 27 ; anododont, scaphiodont.

Distribution. A rare hill snake occurring usually above about 4,000 feet. Only once previously taken in Burma. Has been recorded from the foot of the Hills in the Katha District (Mansi) ; Kachin Hills (Huton, Sinlum Kaba).

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[1] This amends the distribution in my paper on *Oligodon* in this Journal (vol. xxv, p. 331), and my Hand List (vol. xxix, p. 631) in which some of the Districts cited are incorrect.

[2] The dentition is very different from four other species placed in this genus by Boulenger, of which I have skulls, viz., *calamaria*, *rappi*, *frenatus*, and *major*. The maxillary teeth in these four range between 19 and 26, the palatine 11 to 20, the pterygoid 13 to 24 and the mandibular 18 to 27. I have not seen a skull of Cope's *tricolor* so am unable to compare it with the type of the genus.

Series—OPISTHOGLYPHA.

Sub-family--HOMALOPSINÆ.

Hypsirhina plumbea (Boie).

One juvenile specimen from Mandalay.

Length. 212 mm. (8½ inches).

Lepidosis. *Ventrals*, 137. *Subcaudals*, 29.

Distribution. An uncommon water snake occurring in lakes and rivers. The specimen now recorded came from the moat around Fort Dufferin. Has been recorded from Meiktila where there is a lake, Pyawbwe on the Tsamon river and Rangoon.

Hypsirhina enhydris (Schneider)

Eleven specimens from Mandalay. 7 ♂, 5 ♀, and one uncertain.

Lepidosis. *Costals*, two heads-lengths behind the head 23, midbody 21, two heads-lengths before the vent 21 in all the specimens. The scales reduce from 23 to 21, one or two heads-lengths before midbody by a fusion of the 3rd and 4th rows above the ventrals. *Ventrals*, ♂ 161 to 171, ♀ 159 to 163. *Subcaudals*, ♂ 74 to 78, ♀ 59 to 64.

Breeding. A male and a female, both adults, were found in company on 10th May. A female measuring 642 mm. (2 feet 1½ inches) came into Sergeant Murray's quarters about 9 p.m. one night in Mandalay in August 1923. The Sergeant struck it, and after the blow, the snake proceeded to give birth. Seven young were born before she died, and two unborn young were found in sacs within her subsequently. The brood comprised five males and three females, one with a damaged tail being unsexed. The males measured from 201 to 206 mm. (8 to 8¼ inches). The females measured from 185 to 193 mm. (7⅜ to 7¾ inches). The genitalia of the unborn male were not extruded.

Dentition. From three skulls in my collection. *Maxilla*, supports from 17 to 20 teeth; diacranterian. The praecranterian set anododont, feebly coryphodont. Cranterian. A pair of subequal, grooved, obliquely-set teeth rather longer than the last praecranterian. *Palatine*, 10 to 11; anododont, isodont. *Pterygoid*, 20 to 24; anododont, strongly scaphiodont. *Mandibular*, 23 to 25; anododont, feebly kumatodont. I could discover no fœtal tooth in the born and unborn young.

Distribution. A common water snake in Burma living in rivers, inland waters and marshes. Has been recorded from Bassein Rivers (Ngathaing-gyaung); the Irrawaddy River (Mandalay, Sagaing, Prome, Thayetmyo); Rangoon River (Rangoon, Hmawbi); Pegu River (Pegu); Bassein River (Bassein); Sittang River (Toungoo); West of the mouth of the Salween River (Thaton); Tavoy River (Tavoy).

Homalopsis buccata (Linné)

One specimen from Victoria Lake, Rangoon.

Lepidosis. *Costals*, two heads-lengths behind the head 41, midbody 41, two heads-lengths before the vent 33. *Ventrals*, 161. *Subcaudals*, 69.

Breeding. This specimen measuring 798 mm. (2 feet, 7½ inches) proved to be egg-bound, and my donor says it was killed about two months before he sent it. This would be early March. It contained seven elliptical eggs about 28 × 15 mm. (1⅛ × ⅝ of an inch), which appeared to be sterile.

Dentition. From four skulls in my collection. *Maxilla*, carries 11 to 12 teeth; diacranterian. The praecranterian series anododont, kumatodont, fluted on their outer and inner faces basally. The cranterian number two, obliquely-set, and deeply grooved on their anterior faces; little longer than the last praecranterian. *Palatine*, 9; anododont, isodont. *Pterygoid*, 17 to 21; anododont, scaphiodont. *Mandibular*, 14 to 17; anododont, kumatodont, fluted basally on their outer and inner faces.

Distribution. Lower reaches of the Bassein, Rangoon and Salween Rivers and adjacent lakes.

Hurria rhynchops (Schnieder)

One specimen from Rangoon.

Sub-famliy—DIPSADOMORPHINÆ.

Dipsadomorphus multimaculatus (Boie)

One female specimen from Rangoon.

LEPIDOSIS. *Ventrals*, 240. *Subcaudals*, 97.

FOOD. Enormously distended with a large lizard (*Calotes versicolor ?*).

BREEDING. Contained seven small eggs in the oviduct. Date of capture not on record.

DENTITION. From three skulls in my collection. *Maxilla*, diacranterian. The praecranterian series 10 to 11 ; anododont, feebly kumatodont. Cranterian 2 ; subequal ; deeply grooved on their anterior faces ; obliquely placed ; not twice as long as the posterior praecranterian. *Palatine*, 6 ; anododont, scaphiodont. *Pterygoid*, 8 to 12 ; anododont, scaphiodont. *Mandibular*, 14 to 18 ; anododont, strongly kumatodont.

DISTRIBUTION. A common snake in the plains of Lower Burma, and the Southern part of Upper Burma, ascending to an altitude of about 5,000 feet. Seems to be restricted to the valleys of the Irrawady river, South of Mandalay, the Salween river and intermediate streams. Has been recorded from Mandalay ; Thayetmyo ; Maungmya ; Pegu ; Rangoon ; South Shan States Taunggyi (5,000 feet) ; Fort Stedman (3,000 feet) ; Moulmein.

Dipsadomorphus hexagonotus (Stoliczka)

Two specimens from Mandalay and Maymyo.

LEPIDOSIS. *Costals*, in 19 rows two heads-lengths behind the head 19 in midbody, 15 two heads-lengths before the vent. *Ventrals*, 239 and 233. *Subcaudals*, 101 and 102 ? (damaged).

FOOD. A large lizard of the genus *Calotes* in the stomach of one.

DENTITION. From two skulls in my collection. *Maxilla*, diacranterian. The praecranterian series 9 to 11 ; anododont, kumatodont. Cranterian 2, subequal ; deeply grooved on their anterior faces ; obliquely set. *Palatine*, 6 ; anododont, feebly kumatodont.

Pterygoid, 8 to 10 ; anododont, scaphiodont. *Mandibular*, 14 to 15 ; anododont, kumatodont.

DISTRIBUTION. An uncommon snake in the plains of Burma ascending to about 6,500 feet elevation. Haka (Chin Hills) ; occurs in the valleys of the Chindwin, Irrawady, Sittang and Salween rivers from Bhamo and their surrounding hills. Has been recorded from Bhamo ; Katha ; Kunchoung ; Mandalay ; Meiktila ; Thayetmyo ; Pegu ; Rangoon ; Nathaing-gyaung ; Bassein ; Hakai ; North Shan Hills (Maymyo) ; South Shan Hills (Taunggyi) ; Kawkareik in Tenasserim ; at the Western foot of the Dawna Hills.

Boiga cynodon (Boie).

One specimen from Myitkyina.

LEPIDOSIS. *Costals*, two heads-lengths behind the head 23, midbody 23, two heads-lengths before the vent 15. *Ventrals*, 251. *Subcaudals*, 118.

DENTITION. From three skulls in my collection. *Maxilla*, Diacranterian. Praecranterian teeth 10 to 11 ; anododont, kumatodont. Cranterian 3 ; scaphiodont ; deeply grooved on their anterior faces ; obliquely set. *Palatine*, 5 to 6 ; anododont, kumatodont. *Pterygoid*, 8 to 10 ; anododont, scaphiodont. *Mandibular*, 19 to 20 ; anododont, kumatodont.

DISTRIBUTION. An uncommon species occurring in the plains. Has been recorded from Myitkyina; Thayetmyo; Toungoo; Rangoon; Burma—Siam Hills; Mergui.

Psammodynastes pulverulentus (Günther)

Five specimens from Kutkai and Huton.

BREEDING. A female 515 mm. (1 foot, 8⅝ inches) long, killed at Kutkai on the 8th of October contained five eggs in the oviducts.

DENTITION. From three skulls in my collection. *Maxilla*, diacranterian. Praecranterian teeth 10 to 11 ; anododont, anisodont ; first three progressively increasing, 4th and 5th subequal and about twice as long as the 3rd, succeeded by 5 to 6 isodont teeth. Cranterian, 2 ; obliquely set ; deeply grooved on their anteriorfaces ; twice or more than twice the preceding. *Palatine*, 8 to

11; anododont, kumatodont. *Pterygoid*, 21 to 23; anododont, scaphiodont. *Mandibular*, oinododont, anisodont. Praenodal. The first 2 or 3 progressively increase in length, the next 2 are subequal, large, and about twice the preceding. Postnodal, 13 to 15; feebly kumatodont.

DISTRIBUTION. Rather an uncommon snake occurring in the plains throughout Burma, and ascending the hills to about 6,500 feet. Haka (Chin Hills). Has been recorded from Kindat; Chin Hills; Katha; Mogok; Ruby Mines District; Wumbeza; Toungoo District; Pegu; Rangoon; Huton; Kachin Hills; Kutkai; North Shan Hills; Moulmein; Tavoy; Mergui Archipelago.

Dryophis prasinus Boie

One specimen from Huton.

DISTRIBUTION. A fairly common denizen of the plains throughout Burma, ascending hills to about 5,000 feet elevation. Has been recorded from Mansi at the foot of the hills in the Katha District; Shewbo District (Yeu); Toungoo; Pegu District (Pegu, Tadangu); Rangoon; Bassein; Maungmya; Kachin Hills (Huton); South Shan Hills (Taunggyi); Burma—Siam hills.

Dryophis mycterizans (Linné)

Six specimens from Mandalay and Maymyo.

DISTRIBUTION. A common snake throughout Burma, ascending hills to an altitude of 5,000 feet (Taunggyi). Has been recorded from Bhamo District; Shwebo District (Shwebo, Yeu); Mandalay; Myingyan District (Pagan); Toungoo; Pegu District (Tadangu, East of the Yomas); Tharrawaddy District (Shwegyin); Rangoon; North Shan Hills (Maymyo); South Shan Hills (Taunggyi).

Chrysopelea ornata (Shaw)

Fifteen specimens from Mandalay, Lashio, and Rangoon.

HABITS. Lieut. Kurup gave me a specimen he killed in Rangoon which he says leapt from a tree and alighted close to him. He estimated the height of the leap as between twenty and twenty-five feet. He says the snake was extended in its volplane until it reached the ground. Some coolies were in a tree opposite trimming the branches and the snake was probably disturbed by them. Lieut.-Colonel Bell told me of a specimen that jumped from a tree in his compound, and alighted near him but he did not see the whole leap. This was apparently disturbed by a little owl that was in the branches above.

LENGTH. A small specimen, evidently a hatchling from Mandalay measured 225 mm. (9 inches).

DISTRIBUTION. A common snake in the plains of Burma, ascending hills to at least 5,000 feet (Taunggyi). Has been recorded from Sandoway; Mandalay; Thayetmyo; Prome District (Shwedaung); Tharawaddy District (Shwegyin); Toungoo; Pegu District (Pegu, Tadangu); Rangoon; Moulmein; Tavoy; Mergui; North Shan Hills (Lashio); South Shan Hills (Taunggyi).

Series—PROTEROGLYPHA

Bungarus fasciatus (Schneider)

Two specimens from Myitkyina and Taunggyi.

DISTRIBUTION. A common species in the plains, ascending the hills to about 5,300 feet. Has been recorded from Myitkyina; Sagaing; Ruby Mines District; Meiktila District (Meiktila, Pyawbwe); Toungoo; Tharawaddy; Pegu; Rangoon; Moulmein; Tavoy; South Shan States (Taunggyi).

Bungarus multicinctus Blytho

One specimen from Namkham.

LENGTH. A fine female specimen measuring 790 mm. (2 feet, 7$\frac{1}{8}$ inches), the tail 130 mm. (5$\frac{1}{4}$ inches).

LEPIDOSIS. *Ventrals*, 219. *Subcaudals*, 55.

BREEDING. This contained four large eggs in the oviducts measuring 31 × 7 mm. (1$\frac{1}{4}$ × $\frac{5}{16}$ of an inch). This was encountered on the night of the 3rd of April.

DISTRIBUTION. A distinctly uncommon snake in Burma, confined to the plains. Has been recorded from Lower Chindwin (Monywa); North Shan States (Namkham); South Shan States; Meiktila; Toungoo; Rangoon.

Bungarus magnimaculatus Wall and Evans

One female specimen from Mandalay.

LEPIDOSIS. *Ventrals*, 216? *Subcaudals*, 47.

DISTRIBUTION. An uncommon snake occurring in the Irrawaddy Valley from Shwebo to Minbu, and the lower reaches of its tributaries the Chindwin and Tasmon rivers. This corresponds to the dry zone where the annual rain fall is less than fifty inches. Has been recorded from Shwebo; Mandalay; Monyawa; Minbu; Meiktila and Pyawbwe.

Naia hannah (Cantor)

One from Taunggyi, and the heads of three others from Taunggyi, Maymyo and Mandalay (killed in the neighbouring jungle).

LEPIDOSIS. *Costals*. Two heads-lengths behind head 15, midbody 15, two heads-lengths before vent 15. *Ventrals*, 243. *Subcaudals*, 87.

BREEDING. I owe special thanks to Mr. Plunkett, I. F. S., for a very valuable note on the breeding of this snake. When beating jungle for game in April, a great clamour among the beaters announced something unusual had been encountered. On proceeding to the spot he found two large snakes wreathed together. He shot first one and then the other, and when examined after death they were found 'in copula,' and still united. They were dragged apart, and he amputated the male organ and preserved it in spirit. It appears to be the diramic organ of one side. This he presented to me and I have transferred it to the British Museum. The organ is so markedly different from specimens of these organs in the Cobra (*Naia naia*) in my cabinet collection, as to justify *N. hannah* being placed in a distinct genus. Each limb of the organ is about 152 mm. (6 inches) long, from the point of bifurcation to the extremity. A *raphê* passes up the posterior part. The basal four-fifths is surrounded by prominent transverse, somewhat imbricate, folds resembling the gills of a mushroom. Most of the folds extend uninterruptedly right round the organ, others are discontinuous. In the distal fifth the folds are broken up to form a sort of honeycomb. The male measured 3,685 mm. (12 ft. 1 inch) and the female 3,125 mm. (10 ft. 3 inches).

DISTRIBUTION. This is a fairly common snake in the plains and hills throughout Burma, and ascends to an altitude of 6,500 feet (Sinlum Kaba). Has been recorded from around Mandalay; Meiktila District (Mount Popa); Thazi Hills (east of Yamethin); Magwe District (Sun Choung river, Minhla); Toungoo District (in the hills); Tharawaddy District (Shwegyin); Pegu; Rangoon; Moulmein; Kawkareik on the western foot of the Dawna Hills; Kachin Hills (Sinlum Kaba); Chin Hills (Haka); Ruby Mines District (Mogok); North Shan Hills (Lashio, Maymyo); South Shan Hills (Tuanggyi, Kalaw).

Naia naia (Linné)

Seven specimens from Myitkyina, Mandalay, Taunggyi.

VARIETY. All conform to variety *fasciata*. One (with 19 scale rows) from Mandalay appeared at first sight an anocellate specimen but when pegged out six small blackish spots on the left side and three on the right are so distributed as to suggest the usual elliptical mark of *fasciata*.

LEPIDOSIS. *Costals*. One had 19 scale rows, and the rest 21.

DISTRIBUTION. A very common snake in the plains throughout Burma, ascending the hills to an altitude of at least 5,000 feet (Taunggyi).

Calliophis macclellandi (Reinhardt)

Six specimens from Maymyo and Huton.

COLOURATION. The four specimens from Maymyo conform to variety *C. m. macclellandi*; the two from Huton constitute a new variety for which I propose the name *concolor*. It is a uniform rich brown dorsally, with no trace of the black transverse bars, typical of *C. m. macclellandi*, or of the vertebral stripe of *C. m. univirgatus*. Ventrally it has the large black irregularly-shaped spots, typical of *C. m. macclellandi*. The head is adorned with the usual ivory-white band bordered anteriorly and posteriorly with black.

HABITS. One was encountered one evening in Maymyo. It escaped quickly into a bamboo clump. Captain Donelly seized it by the tail, and pulled it out, but narrowly escaped being bitten by a determined snap of its jaws.

FOOD. This specimen had just swallowed a Diard's blind snake (*Typhlops diardi*), 288 mm. (11½ inches) long, which lay fully extended in the gullet and stomach. Another smaller specimen of the same snake 85 mm. (3⅞ inches) long, lay similarly extended in the stomach.

DISTRIBUTION. A fairly common hill species occurring above about 3,000 feet. Has been recorded as follows. *C. m. macclellandi* :—Chin Hills (Haka), Ruby Mines District (Mogok) ; North Shan Hills (Maymyo) ; Pegu Yomas, South Shan Hills. *C. m. gorei*, Kachin Hills (Sinlum Kaba). *C. m. concolor* :—Kachin Hills (Huton).

Family—VIPERIDÆ

Vipera russelli (Shaw)

One specimen from Mandalay.

DISTRIBUTION. A very common snake in the plains of Burma and universally distributed.

Trimeresurus monticola (Günther)

Two specimens from Taunggyi.

LENGTH. One of these is the largest on record. It taped 977 mm. (3 feet 2½ inches) ; the tail 118 mm. (4¾ inches).

DISTRIBUTION. A rather uncommon species confined to the hills above about 3,000 feet. Has been recorded from Myitkyina District (Hpimaw) ; Chin Hills (Haka) ; Ruby Mines District (Mogok) ; Toungoo District (Thandaung) ; South Shan Hills (Taunggyi) ; Dawna Hills (Mount Mulehyit).

Trimeresurus gramineus (Shaw)

Five specimens from Huton, Maymyo, and Taunggyi.

DISTRIBUTION. A fairly common snake in the plains of Burma, ascending the hills to about 5,000 feet (Taunggyi). Has been recorded from Bhamo ; Shwegyin ; Rangoon ; Maungmya ; Moulmein ; Tavoy District (Egaya) ; Mergui and the Archipelago ; Kachin Hills (Huton) ; Chin Hills (Haka. Falam) ; North Shan Hills (Maymyo) ; South Shan Hills (Taunggyi).

THE COMMON BUTTERFLIES OF THE PLAINS OF INDIA (INCLUDING THOSE MET WITH IN THE HILL STATIONS OF THE BOMBAY PRESIDENCY)

BY

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(*Continued from page* 588 *of this Volume*)

PART XXXV

Sub-family (6)—PAMPHILINÆ

This group consists of the genera *Pamphila* with two species only found in the Himalayas and northwards to Amurland and in Burma with eleven others purely palæarctic. *Taractrocera* with eight species in British India and thirteen others in the Malayan Sub-region; *Ampittia* with two species, one Indian, one Burman; and *Aëromachus* with five Indian and two others, the one from China, the other from the Philippines; also *Ochus* with a single species from the N.W. Himalayas to Sikkim and Burma. The genera that are of interest here are *Taractrocera*, *Ampittia* and *Aëromachus* (as represented by Swinhoe's genus *Machachus*); the first of four species that come into these papers; the second of a single species and the third containing two. The species of *Taractrocera* are *mævius* (F.); *ceramas* (Hewits); *nicevillei*, Watson and *oberthüri*, Elwes and Edwards. *Ampittia* is represented by *dioscorides* (F.) formerly known as *maro* (F.)

Taractrocera mævius is an unmistakable species; *T. ceramas*, *nicevillei* and *oberthüri*, all three from S. India, are very doubtfully distinct and are probably only climatic varieties. *Machachus jhora* (de N.) and *indistincta* (M.) may possibly be different from each other.

Imago.—These are all insects of small size living near the ground where they fly over the grass and low herbage with a weak, somewhat fluttering flight, settling often and frequently with the wings more or less parted and spread, showing the upperside; especially do they do this when basking in the sun; they all effect grass lands and, even in jungle country, are chiefly found in clearing where the grass grows. They all feed upon the juices of low-lying flowers such as Vetches and small *Acanthaceæ* that are found amongst the grass. They rest at night on dead grass-stems, dry leaves and twigs, always near the ground and keep the wings closed over the back at that time. Most of the species are black or very dark brown with many grey or yellow markings on both wings on the uppersides, but *Ochus* and *Aëromachus* may occasionally be nearly immaculate. On the undersides of the wings the colours are much the same although differently disposed.

Antennæ.—These are short with a stout, blunt club without apiculus of any kind.

Palpi.—Prominent, well separated; second joint roughly scaled, third erect or conical, prominent, sometimes slender.

Fore tibiæ.—With epiphyses except in *Pamphila*.

Hind tibiæ.—With two pairs of spurs (again excepting *Pamphila* which has only one pair).

Fore wing.—Cell less than two-thirds length of costa; vein 12 ends on costa before end of cell; vein 5 from below middle of discocellulars; 3 from before end of cell; 2 from beyond middle.

Hind wing.—Vein 7 from before end of cell; discocellulars and vein 5, faint; 3 from close to lower end of cell, 2 from beyond the middle of cell.

Egg.—Dome-shaped, rather higher than half the breadth; minutely pitted on the general surface, shining, with a faint cellular network of extremely fine, obscure lines (*Taractrocera*, *Pamphila*) or meridionally ribbed in *Ampittia* and *Aëromachus*. Colour very light-yellow, sometimes blotched red.

Larva.—Of normal shape, the skin translucent, showing the white tracheal tubes through or not; body surface covered with minute, whitish, erect, simple hairs not visible to the naked eye except against the light; the head round-triangular or semi-elliptical in shape and naked; the colour is light-green with a pulsating, dorsal, darker longitudinal line as well as lateral and spiracular whitish line or darker green with still darker dot-spots and subdorsal, dorsolateral and subspiracular, white, longitudinal lines.

Pupa.—Moderately stout with moderate constriction at segment 5, a well-developed cremaster ending in a tiny point on each side at extremity, the free end between them fringed with simple hairs without hooks or the cremaster-end rounded and set with weak little hooked shafts; there are well-developed expansions to the spiracles of segment 2 of various shapes; the head has two points on the frons in *Ampittia*, a horny plate resembling a lappet in *Taractrocera* and is convexly rounded in *Aëromachus* in which genus segment 5 has a small point directed forwards on front margin in the dorsal line under which the body-string passes, the surface of the pupæ is minutely haired when examined under a strong lens. The colour is green of some shade.

Habits.—The butterflies rest with their wings closed over their backs, but bask with them partially opened; they are all insects of grass lands and fly low down above the surface of the earth in a half-fluttering sort of way though they can go fast enough when necessary; they do not fly for long distances and are often seen feeding at flowers growing on the ground. They sit more than fly although they occasionally play about with each other on the wing. At night they sleep close to the ground. The eggs are laid on grass-blades, on stalks and occasionally on a dead leaf, dead stalk and such like objects that are to be found amongst the grass. The larvæ live on the undersides of the blades but often go down to the roots and are rather given to wandering as is only to be expected where they cannot get away from their food. They all make cells of a kind, some cylindrical by joining both edges of the blade together at the tip or by turning over an oblong piece from the edge, or by turning over the tip at right angles to length of blade like the larvæ of many moths of the genus *Rivula* (in this case the cell is more triangular). *Ampittia* pupates quite in the open, lying along a grass stalk with tail-attachment and body-band; *Aëromachus* pupates on the underside of a grass-blade in the hollow made by drawing the edges together but not joining them—as is the habit in the genus *Parnara*.

Genus 22.—TARACTROCERA.

Imago.—All small butterflies of a dark-brown colour on the uppersides, both wings heavily marked with grey or yellow spots which in some species may run into bands or even patches.

Antennæ.—Short, about half costa of fore wing; the club short, broad, in the form flattened, concave disc.

Palpi.—Upturned; second joint densely scaled; third rather long and slender, erect, pointed, reaching above vertex.

Fore tibiæ.—With epiphyses.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Vein 12 reaches costa well before end of cell; upper discocellular very short, middle and lower ones erect, the lower slightly shorter; 5, therefore, from below middle and is curved down somewhat at its base; 3 from a little before lower end of cell; 2 a little before the middle; wing short triangular, costa very slightly arched, outer margin evenly convex, shorter than hinder margin; cell less than two-thirds length of costa.

Hind wing.—Vein 7 a little before end of cell, discocellulars bent somewhat inwards, faint; 5 not traceable; 3 from close to lower end of cell; base of 2 close to base of 3, hardly one-eighth removed from end of cell; costa and outer margin evenly rounded.

Egg.—Dome-shaped, shining, the surface covered with microscopical, superficial cell-like network of lines. Colour very pale-yellow, immaculate or blotched.

Larva.—Light-green covered all over with tiny darker-green dots, the bases of the microscopical hairs with which the body is covered; a dark, pulsating, dorsal, longitudinal line and signs of a subspiracular, yellowish one; a shining-black collar to segment 2. Head rather broadly semi-elliptical in shape, shallowly bilobed; surface rugose-cellular, covered with appressed, fine hairs with a large clypeus; some of the hairs round free edge of anal segment much longer than the generality.

Pupa.—Fairly stout with the front square, the eyes being prominent though rather ventral; a large semi-circular raised disc-like surface on frons; the cremaster ending in two short points with a fringe of straight hair between them instead of hooked shaftlets. Surface of body covered with tiny, erect, reddish hairs except on wings and thorax—these hairs not in any way obscuring the surface of course. Colour that of a bone, very pale-yellowish.

Habits.—Eggs laid anywhere practically amongst the grass. Larva makes a longitudinal cell at point of grass-blade by drawing the edges together. Pupates in such a cell, generally a close fit and always with some excreted cereous powder as a covering. For detail see under the species below.

The species are all Indian and Malayan. There are altogether 21 known. Of these 8 occur within the limits of British India including Burma. They are *Taractrocera mævius* (F.), *ceramas* (Hewits); *nicévillei*, Watson; *oberthüri* (Elwes and Edwards); *danna* (M.); *samadha*, Frühstorfer; *quinta*, Swinh.; *atropunctata*, Watson. *Danna* comes from the N. W. Himalayas; *samadha* from Burma; *quinta* from Burma and Assam; *atropunctata* from Burma and Hongkong. The other four all come from S. India and, for *mævius* only, the rest of India as well and Ceylon and Burma.

211. Taractrocera ceramas (*Hewits.*). (Pl. M. figs. 74 ♂, 74*a* ♀)—Male *Upperside* dark-brown with small orange spots. Fore wing with eight spots, one in the cell, three conjoined from near the costa before the apex, two in the middle of the disc and too close to the outer margin below the apex. Hind wing with two pairs of spots in the disc; one pair in the middle, the other near the apex. *Cilia* of both wings pale-brown. *Underside*: Fore wing blackish-brown, the spots as on upperside but paler and duller in colour and there is a dull orange streak between the costa and subcostal vein. Hind wing paler, markings as above but with an additional spot at the end of the cell and the entire wing more or less covered with minute, orange scales. Antennae black, the lower half of the club white at sides, the shaft with white dots: palpi, head and body concolorous with the brown of the wings; beneath palpi grey, the abdomen with obscure grey bands. Expanse up to 25mm.

The above description is taken from Swinhoe's *Lepidoptera Indica*, vol. x, pp. 116–117. He gives it quite separately from that of *Taractrocera nicevillei*, Watson, the next immediately following and says that it is found (the species) in ' South India ' ; specifying as localities where it has been taken ; ' The type is marked Nilgiris ; we have both sexes from Ootacamund ; Evans records it from the Palni Hills, Aitken from Igatpuri; Elwes from Travancore and Malabar.' He figures the species on Plate 784, figure 2 male, 2a female and 2b the underside. In both the sexes there is a spot on the upperside of the hind wing about half way across the disc at the upper end of the cell and outside it more or less and this spot is not mentioned in the description.

Compare with the above the description of *Taractrocera nicêvillei* immediately following :—

> ' Male. *Upperside* rufous-brown with rather large, more or less quadrate, orange spots. Fore wing with an elongate spot at end of cell divided into two by the fold and a short adjoining streak above it ; a spot near the costa before apex divided into three by the veins ; a spot outside, its upper, inner end often touching the lower, outer end of the other spot ; two spots in the middle of the disc with two or three spots below it decreasing in size, all joined together into a discal based. Hind wing with a lunulate spot at the end of cell that is often indistinct and three discal spots, the middle one outside the others and largest, the upper one small, the lower one generally divided into two by vein 3. *Cilia* of both wings grey with an inner, dark band. *Underside* like the upper. Fore wing with the costa narrowly suffused with orange and a marginal row of obscure, dull-orange spots from apex to end of vein 2. Hind wing with the discal spots larger than on upperside, consequently all more or less conjoined ; an additional spot at the end of cell ; the wing sparsely covered with minute orange scales and indications of some obscure, small, orange spots on the outer margin. Antennæ black, ringed with white with a white patch at the base of the club beneath ; palpi grey beneath; brown above : head and body above and below concolorous with the wings ; abdomen with whitish segmental bands on the underside. Female like the male, but with all the orange spots much smaller as a rule and more separated from each other than in the male ; and, in the fore wing, the spots joined hind-wards to the two spots in the middle of the disc are often wanting.'

The expanse of *Taractrocera ceramas* is given as up to 25mm. ; of *nicêvillei* as up to 28mm.

On comparing a long series of the Kanara species, both caught and bred, it is found that these spots on the wings are very variable, they may be small or they may be large, some of them may even be entirely wanting. There is one specimen with only the very top part of the outermost discal spot on the upperside of hind wing present without a sign of any other markings whatever. On the forewing the spot in interspace 2 immediately below that in interspace 3 may be exactly equal in size to that of interspace 3 or may be larger and the spots below it may be present, quite separated from each other or they may be conjoined into a band or they may be totally wanting ; the costa may be ochreous or not, it generally is ; the marking at the end of the cell may be very bold or it may be quite small. The underside may, on the hind wing, be much suffused with orange or it may be less, the markings may be very clear or they may be blurred ; the area along the hinder margin behind vein 1, that is the abdominal fold, may be very black or it may be suffused with orange. Finally, some of the orange spots may even be whitish or grey, especially on the upperside of hind wing. The *cilia* usually more or less grey above although, even there, often orange in places : while below they are orange always , although, above and below, the brownish, basal band is there. The markings of the antennæ may be grey or orange in different specimens.

Under the circumstances, as *Taractrocera nicevillei* is from Kanara and the type is from Bombay, taken by Colonel Swinhoe, and apparently exists nowhere else and the insect is very variable in every particular that is supposed to separate it from *ceramas*, it is not likely to be specifically distinct and is probably only a local variety if it is even that.

There is still another species *Taractrocera oberthüri*, named by Elwes and Edwards from Trichinopoly, a single female; and Swinhoe states there are two males from the Anamally Hills in the British Museum. This is, according to the pictures in *Lepidoptera Indica*, much more heavily marked than either *ceramas* or *nicêvillei;* but the material upon which it was based, a single female, appears to be very inadequate in view of the variations in specimens from Kanara.

In the form *nicêvillei*, the imago has the ochreous costa of the fore wing on the upper side due to orange scales; and there are also some similar scales from base for a short way out in the cell, others forming an obscure streak along inner margin from base outwards sometimes as far as half the length of that margin; there is a fringe of fuscous hairs along the inner margin too. On the hind wing there are some longish, decumbent hairs in cell and below it reaching to about middle of disc.

The early stages of the Kanara form given as *Taractrocera nicêvillei* in *Lepdioptera Indica* are given below.

Egg.—Dome-like in *shape*, more than half as high as broad. *Surface* extremely minutely tuberculate-frosted covered with very superficial, extremely finewalled, hexagonal cells under the microscope, each cell about 0·033mm. in diameter; the whole shining. *Colour* very light yellow immediately after it has been laid; soon becoming largely red blotched, the blotching consisting of an irregular band of considerable width round the broadest part and a big blotch on apex. B : 0·8mm.; H : 0·5mm.

Larva.—This larva is rather of the *Udaspes* or *Notocrypta* type in general shape; it lies hunched with the segments 2–5 highest of the whole body; the head, however, is rather larger in proportion than in the larvæ of those two genera, the neck or segment 2 is rather thicker; the anal end has segment 13, a transverse piece of about one-third the length of 12; segment 14 is large, very broadly and bluntly semi-elliptical in shape, convex transversely and tumid round the margins, rather rough tuberculate—this segment remains intact when the skin is cast, that is it is then as broad and as long as ever on the end of the shrivelled rest; the claspers, pseudolegs and true legs are all short and rather weak, the transverse section of the body is circular from segment 2 to segment 12; segment 13 is shallower and segment 14 is flattened ventrally much more than the others and considerably over-reaches and overhangs the anal claspers. The *head* is large compared to segment 2 and is as high and broad as segment 3 at front margin; it is broadly semielliptical in shape, rather thin and has a very slight, shallow sinus on vertex; the surface is rugose-reticulate, the ‘ threads ’ of the reticulation occupying much less space than the hollows and being shining while the hollows are dull, covered with appressed, short, light, hardly visible hairs and with some much longer, erect, shining hairs about mouth opening; the true clypeus is narrow, about half the height of the face (rather less) and lozenge-shaped with the lower end truncated at labrum, the apex acute; the false clypeus broad outside it, also acute at apex, nearly mucronate, about two-thirds the height of the face; the labrum is small, transversely lozenge-shaped, reddish; the ligula is of medium size with a large triangular sinus that is both deep and broad, the colour black; the antennal basal joint is black, the second light; the mandibles are dark, the eyes black;

the colour of the head is black or very dark brown with the false clypeus soiled-white and a soiled-white, narrow band or broad line starting from the edge of the mouth-cavity and running up to the front vertex of each lobe where it is joined to another soiled-white, equally broad, straight line which has its origin on the margin of the false clypeus at the height of the apex of the true clypeus ; the true clypeus is also really soiled-white but darker than the other marks and its dorsal line only is black. *Surface* of body is dull, covered with minute, conical, brown tubercles from each of which springs an erect, fine, conical, light hair about as long as the distance between two adjacent tubercles and the distance between two tubercles is about four times the diameter of one of them ; there are a few erect hairs more than twice the length of these on each segment, but it is not sure that these are symmetrically arranged—any way there seems to be one dorsolateral on each ; on the anal segment there are a lot of still longer erect hairs all over the tumid border as well as a dorsolateral one on each side in the middle—some of these are as long as half the length of the whole segment ; each segment is transversely impressed parallel lined in the posterior half, parallel to the hinder margins as usual ; there seem to be about five such lines to each. *Spiracles* very small and nearly round, slightly raised, light yellowish ; those of segment 2 much larger and those of segment 12, perhaps, slightly smaller than those of segment 2. *Colour* of larva is light glaucous green dotted all over with darker green round dots ; a darkish purple, dorsal line and signs of a similar dorsalateral one as well as a thin, yellowish, subspiracular line ; the ventrum not glaucous ; the anal segment darkish on dorsum anteriorly ; segment 2 with a shining black collar from spiracle to spiracle ; feet whitish ; true legs very light yellowish, L : 20mm. ; B : 3mm.

The black collar of segment 2 is broken narrowly in the dorsal line, the spiracles are broadly oval ; there are about 15 rows of tubercles to one segment-length which is about 2·25mm. ; that is each tubercle is about 0·15mm. from the next.

Pupa.—The body of the pupa is cylindrical in shape, very slightly fattest in the middle, from the shoulders to segment 9 inclusive, after which it gradually thins down to the broad, blunt end, segment 13 being distinct, transverse and less than half the length of segment 12—a narrow, transverse ring—which is the same length as 11, but the pupa has the dorsal line sloping considerably from 11 backwards while the ventral line is throughout more or less straight except at the very end where the anal segment 14 is bent down somewhat and of a peculiar shape : it is very little narrower than segment 13, very nearly as long dorsally as segment 12 but very short ventrally so that its hinder face slopes in ventrally, its dorsal surface being flat (very slightly convex) and transversely broad-oblong, divided from the lateral faces by a strong, prominent ridge on each side, these ridges diverging slightly backwards and each ending in a short tooth or point, the free margin (end of pupa) between them quite straight ; the *head* is also somewhat peculiar : it is broad with the vertex fully exposed and dorsal, twice as long as the narrow, oblong segment 2 with straight margins behind it, sloping with segment 2 at an angle of about 30° to the longitudinal axis of pupa, the frons at right angles to that axis with a peculiar, circular, slightly rugose, generally black disc or plate in its centre, this plate gradually rising from the surface and free in its anterior quarter (pointing downwards), the eyes prominent and somewhat ventral ; the shoulders evenly rounded, well-developed ; the thorax with its first third with the same dorsal slope as segment 2, gradually becoming parallel to the longitudinal axis, the segment nearly as broad as long, the hinder margin a somewhat pointed quarter-circle meeting the wings in a broadly rounded angle of nearly 90° ; segment 4 about half the length of 5, thorax a little less than 4, 5 and 6 together ; the segment-margins well marked the bevilled edges of segments 8–11 flat ; the proboscis reaches free beyond the wings to the end of segment 9 ; the antennæ are short and club-shaped at ends reaching only about half way towards end of wings. *Surface* not particularly shining, with a clothing of little reddish, erect or semi-recumbent, short hairs everywhere except on the segmental membranes, wings, shoulders and a large portion of the dorsal, posterior part of thorax, head and segment 2, these hairs not obscuring the surface anywhere ; fringe of hair at posterior and anterior margins of eyes and a conspicuous row of longer, stiff bristle-like hairs along the posterior margin of anal segment that are as long as that segment itself, about 20 or 25 in number, simple, reddish, pointing straight back. *Spiracles* of segment 2 are indicated by each a large oval, convex, red plate or rising, about as long as segment 2 is long, with a plushlike, grey bloom on the surface in certain lights ; the rest small, narrow ovals, yellowish in colour. *Colour* is yellowish dead-bone with the cremastral (anal) segment red-brown of a bright shade, the wings somewhat lighter than the general body-colour and the head and segment 2 slightly soiled. L : 13mm. ; B : 3mm.

Habits.—The egg is laid as a rule on the underside of a blade of grass ; but, occasionally, practically anywhere ; on the stem, on a dead leaf fallen amongst the grass, etc. The little larva emerges therefrom in three to five days according to weather and warmth of the sun ; it eats the shell and then proceeds to the tip of a grass-blade and makes a house by joining the edges of the leaf together, often quite a long cell for such a tiny thing. It coats the inside with silk although not very thickly and lies along the midrib. This method is persisted in throughout its life, making the house somewhat larger when big of course. It feeds, at night and in dull weather often also during the day, at first close to the cell, later wandering quite a lot. It is active and runs out of the cell sometimes, when disturbed, quite quickly ; also, if the disturbance is continued, falls to the ground and curls up, feigning death. When about to pupate, the larva makes a cell often of a withered leaf, closing both the ends with silk, one rather lightly through which the butterfly will emerge, the other tightly ; the pupa is no way attached inside and is covered with a waxy, white powder which also clothes the walls of the cell. The pupa is a close fit and the cells are often found, detached from anything, on the ground amongst the grass. Occasionally several dead leaves are used to make the pupal cell. One lot of caterpillars were obtained in October and had ceased eating by about the 25th of that month. These remained as caterpillars in a pupal cell until February 12 of the next year when they pupated. The butterfly appeared in about a week afterwards.

The head of the egg-larva measured 0·45 mm. × 0·55 mm. ; was black, shining-smooth, semi-elliptical with a single row of tiny pits along the dorsal line and sides of clypeus ; a very few erect hairs about the mouth. In the second stage the head was 0·65 mm. by 0·7 mm.; the same as in preceding stage short, erect hairs on surface; eyes glassy. Third stage 0·925 mm. by 1 mm. ; nearly black, shining, reticulate-rugose with similar hairs to last stage. Fourth stage 1·6 mm. by 1·4 mm. ; more rugose, the hairs longer, stronger, downcurved, black, about 0·05 mm. apart and as long (0·05 mm.). Final stage 1·75 mm. by 1·5 mm. with details as above described.

The food of the larva is grass of any species as long as it is not too hard and big ; rice is quite an ordinary thing to find it upon. The habitat of *Taractrocera nicevillei* is S. India and it is commonly to be found in the grassy glades in the jungles of N. Kanara District, as well as in the neighbourhood of forest both on the coast (on the hills near it at a height of 1,000′—some are not more than a mile or two from the sea-shore) and above the ghats at 1,000′ and upwards. It is probably a butterfly of heavy rainfall absent from the Plains. The insect never rises high off the ground, is not very partial to sunlight and may be found flitting just above the tops of the grasses settling at frequent intervals on a blade or stem, often even on the bare ground ; frequently in the basking position with the front wings slightly opened, the hind wings more opened still. Two individuals will often play with each other in the air, circling at a low elevation within a small area ; the ordinary flight is of the usual skipping or jerking variety from which the family has got the name of Skippers.

The figures of the male and female, No. 74 and 74*a* respectively on the coloured plate M are quite good but as usual a trifle too red.

212. Taractrocera mævius (*F.*)—(Pl. M., figs. 76, 76*a*).—Male. *Upperside* olive-brown with white markings. Fore wing with a short streak on and above the median vein (the bottom of the cell) in the middle of the cell ; another above it at upper end of cell with two (or one) short streaks between it and the costa, sometimes connected together ; a series of spots in two parts across the disc, three conjoined from the costa near the apex in interspaces 6, 7 and 8 and four commencing with one near the base of interspace 3 separated by the vein from another nearly in the middle of interspace 2 separated again from the third and fourth that form an inwardly oblique band in the two interspaces below ; these last four spots quadrate and slightly excavated on outer side ; two more spots beyond towards margin in interspaces 4 and 5. Hind wing with a series of small spots in almost a straight line in the middle of the disc, four in number in interspaces 2, and 4, 5, the latter slightly outwards ; another above and further in in interspace 6 and two at end of cell ; the ones at the end of cell and the other single, uppermost spot may be extremely faint at times. *Cilia* of both wings grey with white tips, more prominently white towards tornal angle of fore wing and in hinder part of hind wing. *Underside* with the colour similar, almost as dark as on upperside with the markings similar but, on the hind wing, there is a bar across end of cell and spots in interspaces 6 and 7 beyond. Antennæ black ringed with white, the club with a white basal patch on underside ; head and body concolorous with wings ; abdomen with white, segmental bands.—Female. *Upperside* like the male but somewhat paler, the spots larger and more prominent. *Underside* with the markings as on the upperside. Fore wing with the costal and apical portions whitish, the veins below the costa and at the apex white ; a narrow, white outer, marginal band and a black, marginal line. Hind wing entirely suffused with white, all the veins pure white. Expanse up to 27mm. or slightly more ; the males smaller (Swinhoe, *Lepidoptera Indica*).

In a large series bred in the Dharwar District, Bombay Presidency, there is a short ochreous band of scales from base of fore wing along the costa over cell and a very pale blue scale-band along the inner margin from base to half way with another, shorter, above vein 1, and there is a sparse fringe of grey hairs along inner margin. On the upperside of hind wing there are some long, grey hairs decumbent in cell and more numerous ones below cell from base to quite three-quarters way to outer margin. Underneath on both wings there are ochreous scales, the hind wing being covered with them ; all the veins have white scales along their whole length on the hind wing and apical portion of fore wing ; the abdominal fold of hind wing is sprinkled with white scales only. The hairs of the patagia are tipped with yellow where they abut on the costal yellow band of fore wing, the palpi are clothed with brown and yellow scales above ; the third joint being black. Numbers of the females have the spots on fore wing yellowish, all the males have them white.

Egg.—Dome-*shaped* ; rather higher than half the breadth. *Surface* is shining somewhat, covered with a network of lines under a strong lens under the microscope they are minute, thin-walled, low cells of about 0·025mm. diameter ; on the top is a smooth space ; circular, darker than the rest. *Colour* that of a dry bone. B : 0·925mm. ; H : 0·6mm.

Larva.—The *shape* is that of any of the genera *Telicota*, *Halpe*, etc. The head rather small for the larva though, as usual, large for segment 2 ; on the whole body is thickest about middle though little thicker there than at segment 4 or segment 11 ; the anal flap is large and a short semi-ellipse in shape, overhangs the anal claspers by a considerable amount, is flattened a good deal on the dorsal aspect, is not particularly thickened round the edge and is quite as broad as segment 13 for half its length ; segment 13 is a transverse band about one-third the length of segment 12. The *head* is a little broader than segment 2 and a good deal higher, somewhat deeply—though not very considerable—bilobed, the lobes somewhat moderately broadly rounded, the sinus on vertex separating them triangular and inclined to be broad ; the general shape is more than half a short ellipse ; the face is moderately convex ; the clypeus is large, reaching more than two-thirds of the height of the head—this may be the false clypeus and then the true clypeus is not distinguishable easily—and the sides of the clypeus are outwardly somewhat convexly-curved ; the surface is finely honeycombed-rugose and covered with minute, short, simple hairs which are only visible under a lens, the colour is black-brown with the false clypeus outlined somewhat diffusely and not very narrowly soiled yellow-white ; inside this, again, the true clypeus is triangular, higher than broad by a good deal (perceptible as clypeus in certain good lights I see now) and may be outlined also thinly soiled yellowish-white ; besides these markings there is a similar white band running up the face parallel to the central or dorsal line, subdorsal on each side to vertex of each lobe where it turns sharply down again to nearly reach the eyes separating the face from the cheeks ; the subdorsal band does not go further than the upper part of the white bordering of the false clypeus ; there is a soiled yellow-white, rather large spot below and behind the eye curve ; the labrum is very narrow and not long, glassy in colour ; the ligula roundly kidney-shaped and soiled red-brownish ; the antennal joints light ; the mandibles dark-tipped ; the eyes dark. The *spiracles* are small, roundish, light brownish-yellow, those of segment 2 oval and much larger, those of segment 12 only slightly larger : all very slightly raised. *Surface* of body is dull, covered all over with minute, short, erect, simple hairs with a few on each segment slightly longer ; the hairs round the anal flap-edge much longer, especially some four or six of them, light in colour. Colour light opaque-looking yellowish-green with a dark-green, pulsating dorsal line and a lateral less dark-green shade. L : 20mm. ; B : 3mm.

The transverse, thin, impressed, parallel lines towards the hinder part of each segment are also here as usual. Segment 2 has a broad-linear, shining, chitinized, black collar from over spiracle on one side across dorsum to the same place over the opposite spiracle. Ventrum green ; prolegs ditto ; true legs shining green with black extreme tips. The body colour is punctuated, so to speak, by little darker green dots which indicate the bases of the little body-hairs ; segments 2, 3, 4 have these dots still smaller and blackish.

Pupa.—It is somewhat of the *shape* of those of the genera *Halpe*, *Telicota* ; rather long and slim with the front end broadly blunt and very slightly convex, the anal end narrowly blunt, the sides parallel, the shoulders slightly broader than the head and the segment 2 (which are of the same breadth one as the other), a very slight constriction between shoulders and head ; the breadth the same practically from shoulders to segment 8, afterwards thinning very gradually to segment 11, more rapidly, then, to anal extremity ; segment 13 a complete band, half the length of the segment 12 ; the cremastral segment transverse oblong a little longer than segment 13, the posterior side (extremity of pupa) rounded and ledge-like between the posterior corners which are each thickened (with the lateral side) and produced out backwards into a short, conical pointed tooth, the two teeth diverging from each other or from dorsal line of pupa ; underneath this ledge, indeed from ventral surface thereof, proceeds a fairly dense fringe of simple hairs all along its length, these hairs golden orange and directed straight backwards and all about the same length as the segment or nearly as long ; the *head* frons is perpendicular to the longitudinal axis of the pupa and very slightly convex with, at its lower edge, in the dorsal region, a curious little lappet which covers the base of the ligula: this lappet shaped like three-quarters of a circle and free (though, of course, rigid) round the edge (the rounded part) though continuous with frons at base (the base or origin, the upper or posterior part), the breadth of this lappet about half that of the whole frons, though only one quarter of the whole breadth of front of pupa ; the vertex of head short, slightly inclined towards longitudinal axis of pupa and composed of an anterior simple half and a posterior half divided into two lateral, oblong strips, one on each side of dorsal line continued to the base of antennæ on each side and coming to points where they meet in the dorsal line—which is all, both the lappet and these strips, a characteristic arrangement or development ; thorax with the front margin straight, the whole segment evenly rounded, of moderate length, the front slope at about 30° to longitudinal axis, the apex or highest point about the middle of the segment with a very slight and gradual fall to the hinder margin which is a parabolic curve with somewhat excessively diverging arms (or an equilateral triangle with the apex broadly rounded) meeting the wing lines in a broadly-rounded angle of about 45° so that segment 4 is largely exposed in the lateral region on each side though of normal length in the dorsal line ; the proboscis reaches free beyond the ends of wings as far as the posterior margin of segment 9 and beyond to the middle of segment 10. *Spiracles* of segment 2 large, longly oval, considerably convex bodies or surfaces on the front marginal surface of segment 3 which is gently produced forwards for the purpose of accommodating them : the colour being golden-orange-brown ; all the other spiracles are very small and oval, slightly raised and light brownish-yellow in colour. *Surface* of pupa dull, slightly and finally aciculate-scratched transversely and covered very sparsely with small, short, erect, reddish, pointed hairs, these hairs (none of them are easily seen except with lens) longer and stronger on the upper and lower 'eyelids,' less strong laterally on posterior and anterior thorax, laterally on segment 4 and ventrally on the lateral portions of abdominal segment, especially segment 14. The *colour* is livid very light yellow—the colour of a fresh bone, the lappet on head-frons brown, the tail points and ledge red-brown. L : 13 mm. B : 3 mm. The pupa is covered with a slight cereous powder ; white.

Habits.—The eggs are always laid singly on the blades of grass, either on the upper surface or on the under. The little larva eats the shell completely and immediately proceeds to make a cylindrical cell either at the side of the blade by turning over the edge or at the tip by doubling the leaf and fastening the edges together. The cell always is a tight fit for the larva and is only changed when necessitated by the gradual growth. The growth is not rapid. Eggs were laid at the end of July and beginning of August ; on August 4 there were some small larvæ on the grass ; none of these pupated until September 4 so that one month is about the period for complete growth. The pupation takes place in a tight cell made of a blade or blades of grass which is close-fitting and well-closed ; the grass may be withered or not but not dry and hard. Practically any grass is eaten by the larva. The butterfly is common in Dharwar in the grass-lands round about. It is found also locally below-ghats : in Bhatkal near the coast and round Gokarn. Not seen in Karwar. It flies low and rather weakly over the grass, resting often on the ground or on a low leaf, basking in the sun with its wings half open ; it rests at night amongst the grass or under the shade of bushes on their leaves ; it visits flowers frequently and never flies very far at a time, nor high. It is not scarce in the grass lands on the open country above the Western Ghats. Swinhoe gives its habitat as India, Ceylon and Burma.

The distribution he gives as follows :— 'In our collection from Mhow ; Poona ; Ranikhet ; Maymyo, Upper Burma and Trincomali in Ceylon ; recorded by Elwes from Sikkim ; Calcutta and Ganjam ; by Hannyngton from Kumaon ; by de Rhé-Philipe from Lucknow and Masuri ; by Aitken and Comber from the Konkan ; by Fergusson from Travancore ; by Moore from Kangra ; by Doherty from Kumaon and by Adamson from Toungoo and Moulmein ; it is widely spread all over India, Burma and Ceylon but is very local.'

The figures of the male and female butterfly on Plate M, numbered 76 and 76*a* respectively are not bad ; but, again, they are much too red ; the underside of the hind wing of the male should have the veins white as well as the spots.

Genus 23.—AMPITTIA.

Imago.—Small butterflies of the aspect of *Taractrocera* but the males with the yellow developed into large patches divided into large conjoined spots by the black veins ; the undersides of hind wings more yellow with black spots than black (or brown) with yellow spots and the abdominal fold concolorous with the rest, not blackish as in *Taractrocera*. There are two species, one *dioscorides* (F.) and *maroides*, deN. The latter is from Burma and Perak and is not easily distinguishable from *dioscorides*, if it is, indeed, a different species.

Antennæ.—Short, about half the length of costa of fore wing ; the club moderated, straight, blunt.

Palpi.—Upturned, densely clothed; third joint erect, its tip, which is bluntly conical, reaches over vertex of head.

Fore tibiæ.—With epiphyses.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Vein 12 reaches costa well before end of cell ; upper discocellular very short but distinct in almost a straight line with the middle and lower, the last somewhat shorter than the middle one, vein 5 therefore slightly nearer 4 than to 6 ; vein 3 from a little distance before end of cell in the male, from close to end in female ; 2 from a little beyond middle ; cell less than two-thirds the length of costa, shaped like an elongated triangle, lower margin somewhat inwardly curved from base of 2, bent upwards from 3 to the end. Wing short and broad ; costa very nearly straight, apex angular ; outer margin very convex, a little shorter than hinder margin. Male with a short, glandular streak on upperside immediately below origin of vein 2 but not touching either 2 or 1.

Hind wing.—Vein 7 emitted one-third from upper end of cell, curved up at its base, the outer margin of cell inwardly curved from origin of 7 to end which is rounded ; discocellulars faint ; 5 not traceable ; 3 from very close to end of cell ; practically touching it ; 2 from less than one-fourth before end ; costa and outer margin evenly rounded.

213. Ampittia dioscorides. (*F.*)—Male, *Upperside* bright golden-yellow ; costal line black, after margin with a broad, even, black band, very slightly but squarely bulged inwards at the hinder angle ; a broad, black band on the hinder margin with two golden-yellow spots in it, one a little before middle, the other a little beyond middle ; a black band running up from the middle of hinder marginal band to costa one-third before apex, throwing out a cross-band from above its middle and joining the marginal band ; in some specimens this discal band is disconnected from the costa from the cross-bar. Hind-wing blackish-brown with an irregular-shaped, short, broad, discal, golden-yellow band, composed of spots divided by the veins, the two central ones elongated, the lower ones small. *Cilia* brown, touched in parts with golden-yellow, especially at anal angle. *Underside* : Fore wing as above but the extreme outer margin is more or less golden-yellow. Hind wing with the ground-colour golden-yellow, most of the wing covered with minute, brown scales ; the discal patch as above, edged with pale-brown and a series of pale-brown, submarginal spots all round the wing from base to anal angle. Antennæ black ringed with yellow ; the club yellow on the underside and at tip ; palpi, head and body brown above, palpi and head marked with yellow ; beneath all yellow.—Female. *Upperside* : dark-brown. Fore wing with a yellow spot at end of cell and a discal series of yellow spots ; two, sometimes three, divided by the veins, from near the costa one-sixth from apex and two in the middle of the disc in interspaces 2 and 3 with another small, in interspace 1 ; an indistinct series of submarginal, yellowish spots on upper half of wing. *Underside* : paler. Fore wing has the spots as above, but larger ; a yellow, subcostal streak from base to beyond middle. Hind wing with many minute, yellow scales in parts, a discal series of yellowish spots and a submarginal series. Expanse up to 25mm. (Swinhoe, *Lepidoptera Indica*.)

The description is not very good. In bred specimens there is, on the upperside of fore wing in the male, an orange streak along the inner margin, and a streak above it from base to one-third of the way out instead of a broad, brown band ; there is also a thin orange line parallel to outer margin in the middle of the broad marginal, brown band reaching from costa just before apex to vein 4; the *cilia* have orange brown interspaces as broad as the orange ones at ends of veins, the basal half all brown. There is a brown fringe of hairs along the inner margin. The antennæ have the club with a dull-orange tip ; on the hind wing upperside there are some long yellow hairs in the cell, decumbent and a line of similar ones along vein 1. *Underside* : hind wing orange with a series of brown, largish spots between the veins just inside the margin, all of them powdered with orange scales ; the discal orange markings of upperside showing through and outlined by brown powdered with orange scales ; a large brown spot in interspace 7 and a somewhat smaller one above it in interspace 8, the absolute base of wing also brown. In the female all the male markings are present but so reduced in size as to give the insect the appearance of a *Taractrocera nicevillei* ; and they are more yellow than orange. The males are really very like *Padraona gola* to look at.

Egg.—The shape is that of a dome, rather unusually high. *Surface* shining and sculptured with 24 meridional ridges from base up to more than three-quarters the height where they lose themselves ; the top obscurely, minutely reticulate-lined, even slightly concave. *Colour* light-yellow becoming light-green some time after it is laid. B : 0·9 mm. ; H : 0·6 mm.

Larva.—Of the usual *shape*, thickest in the middle, fining to both ends ; circular in transverse section except head and anal segment ; the latter rather longly semi-elliptical, sloping at about 30° to longitudinal axis of body and somewhat flattened ; the head about as broad as middle of segment 3, broader than segment 2 and slightly higher. *Head* nearly round but slightly higher than broad with a triangular clypeus which is higher than broad, reaches more than one-third way up the face ; outside it is the false clypeus reaching more than half way up, also triangular and slightly curvilinear, the sides convex outwards ; the apex acute ; the surface is shallowly cellular-rugose, covered with extremely short, erect white hairs, all of the same size or length and light in colour ; only visible under a lens and then only when looked at sideways ; the labrum, ligula and antennal joints and the ground colour of the head rather soiled yellowish white with two reddish longitudinal stripes on each lobe and yellowish white mandibles with dark-brown tips ; eyes dark and light : some the one, others the other. *Spiracles* soiled white, small, broadly oval, somewhat convex, those of segment 2 much larger, those of segment 12 a little larger. *Surface* as usual with this type of skipper, covered all over with minute, erect, rather densely disposed hairs which are white in colour and all of one length, visible only under the lens ; those on the anal segment reddish and more visible, those round the margin of that segment a good deal longer and white. *Colour* grass green with a broad longitudinal, subdorsal, white stripe, a dorsolateral and supraspiracular, narrow white band or line and a spiracular, thin, yellowish line ; the true legs, ventrum prolegs green ; the whole dorsal surface (as distinguished from the ventral) slightly glaucous except the dorsal broad line which is the only really grass green part. L : 22mm. ; B : 3mm.

There is a small, deep-black dot or spot dorsolaterally on segment 2 which is the only mark of any importance besides the longitudinal white stripes already mentioned in the description above.

Pupa.—A little, green pupa formed on the stem low down, the head always pointing down. It is abnormal in having a short frontal process on each side of dorsal line of the *head* which springs from the dorsolateral region and is directed out sideways in front of the eye the upper hinder margin of which it just over-reaches ; it is directed also slightly forwards away from the frontal surface and is triangular flattened anteriorly and posteriorly, with somewhat broken edges, and the outer surface is roughened : the two together, seen from above, looking like a short pair of horns with a wide sweep. The *shape* of the pupa is nearly circular in transverse section from the thorax to segment 13, the ventrum slightly flattened, the greatest breadth at the shoulders whence it gradually thins to the strong, triangular, broadly round-topped, somewhat down-curved cremastral segment which is nearly as long as segments 11, 12 together, rather thin through with the dorsum mostly occupied by a longitudinal depression which is triangular in transverse section : the suspensory hooklets small and at the extremity spread out fan-wise ; the highest point is the apex of the thorax whence (from just behind the shoulders) the dorsal slope to frons is a straight line at an angle of about 45° to the longitudinal axis of the body ; the head-vertex forms the front base of this slope, and it has its hinder margin curved convexly towards segment 2 ; segment 2, immediately following it is about the same length, with its hinder margin straight ; the thorax is smoothly rounded, rather humped, the shoulders hardly at all prominent, the hinder margin of the segment a more or less parabolic curve meeting the wings in a rather broad, deep, rounded angle of somewhere about 44° ; segment 4 in dorsal line slightly shorter than segment 5 ; segment 13 very short ; segment 12 half the length of segment 11 ; the proboscis alone but none of the legs or antennæ reaches the ends of the wings. *Spiracles* of segment 2 are indicated by, each, a rather large, very slightly-raised, flat, opaque-white, semicircular space on the surface of segment 3 immediately behind each ; the rest are small, nearly round, slightly raised, yellowish. The *surface* of the pupa is shining, very finely and shallowly transversely aciculate and granulate, perceptible only under the lens—except the frontal processes which are as above described. The *colour* is grass-green, light and slightly glaucous, with the white markings of the larva ; the thorax, head and wings hardly glaucous ; there is a minute lateral and dorsolateral, shiny-smooth dot just behind the front margin of segment 2. L : 26mm. ; B : a little over 3mm.

Habits.—The butterfly lays its eggs singly upon the leaves of the rice. The little larva eats from the edge of the leaf and lives in a cell made at first by joining the edges of the leaf at the point, when more grown by turning over the top of the blade at right angles to the length of it, coating the inside with silk. Pupation takes place in the open ; the pupa is attached, head down, by the tail and a body-band to a rice-stem just over the surface of the water. Twenty-five eggs were dissected out of a female. The butterflies are generally found round the rice-fields in Kanara in the monsoon months but also elsewhere in open spaces where there is grass. The larva was first discovered in N. Kanara District on rice and the first pupa was also found in a rice-field in the position just noted. That was in the year 1894. Many more butterflies have been bred since those days and the pupa always is formed along a stem in the same way even when there is no water. They are weak fliers and flit about over the rice in much the same way those of the genus *Taractrocera* do over grass ; sitting in the same way to bask on the leaves with the wings partly open to the sun. At night they rest with them closed over the back. The habitat is given by Colonel Swinhoe as Sikkim, S. India, Ceylon, Burma, Malacca, Annam and Sumatra (*Lepidoptera Indica*, vol. x, p. 126; figures are given on Plate 786 of the male upperside No. 1, male underside No. 1*b*, female upperside 1*a* and underside 1*c* together with larva and pupa No. 1*d*); the distribution is alluded to as follows :—'The type of *dioscorides*, a female, came from Tranquebar and is in the Museum at Copenhagen; the type of *maro*, in the Banksian cabinet in the B.M. from Ceylon; we have both sexes from Hue, Annam; Trivandrum; Madras and Ceylon; Evans records it from the Palni Hills; Fergusson from Travancore; Betham from the C. P.; Watson from the Chin Hills, Beeling and Pegu; Moore from Mergui and Ceylon; de Nicèville from Sikkim; Davidson, Bell and Aitken bred it in Kanara; we give copies of Davidson's original drawings of larva and pupa.' He says positively that there is no difference between *dioscorides* and *maro*.

Genus 24.—AEROMACHUS.

This is divided into two by Swinhoe; one genus he calls by the original name and reserves for those species that, in the male, have a sex-mark; the other he has christened *Machachus* for those which have none. The only species that concerns us here comes into this latter. Swinhoe has two species of *Aëromachus* named *stigmata* (M.) and *dubius* (El. and Ed.), the former from N. W. Himalayas, Sikkim and Assam; the latter from the Palni Hills, Peermade, Travancore. In *Machachus* he places three called *jhora* (deN.), *kali* (deN.) and *indistincta* (M.) from, respectively, Sikkim, Assam and Burma; Sikkim and Burma; S. India, Ceylon, Burma, Java, Sumatra.

Imago.—These are the smallest of Indian Skippers, varying from 20mm. to 25mm. in expanse. They all have the uppersides of both wings immaculate brown except for, in some, on the fore wing, a postdiscal series of always small, whitish dot-spots between the veins from interspace 2 to interspace 8, this series forming an absolutely even curve. The undersides are generally somewhat lighter with the postdiscal series of spots showing through and a similar series on the hind wing.

Antennæ.—With the club robust, blunt (at least in the Kanara species understood to be *jhora* from Swinhoe's description) at the end, although conical.

Palpi.—With the second joint pressed closely against the face, third joint porrect, not particularly short, conical.

Hind tibiæ.—With two pairs of spurs.

Fore wing.—Vein 12 ends on costa before end of cell; 5 from below middle of discocellulars, 3 from before lower end; 2 from about one-third before end; cell less than two-thirds length of costa; costa slightly, evenly curved; apex well pronounced; outer margin convex and shorter than hinder margin.

Hind wing.—Vein 7 from before upper end of cell; discocellulars and 5 faint; 3 from close to lower end; 2 from beyond middle.

Egg, larva, pupa, habits.—See below under *jhora*, the only species for which they are known.

214. Aeromachus jhora, *Swin.*; **indistincta** (*M.*).—*Upperside*: uniform olive-brown without any markings; in some individuals there are faint indications of some discal and submarginal markings. *Cilia* concolorous with the wings, the tips paler. *Underside* paler; a small whitish spot at end of cell, sometimes absent; an indistinct, whitish, outwardly-curved, discal band, thin and from near the costa half way down the wing; the upper and outer portions of the wing covered with minute, white scales. Hind wing entirely covered with minute, white scales; traces of a whitish, outwardly-curved, discal band, a very faint series of submarginal spots a little darker than the ground colour. Antennæ black, ringed with white; the club whitish on the underside, all except the tip; palpi, head and body above concolorous with the wings, whitish on the underside. (Swinhoe in *Lepidoptera Indica*, vol. x, p. 196. Figures are given on Plate 802 of the same book, No. 5 of the male, 5*a* of the female, 5*b* of the underside).

Egg.—The *shape* is that of a somewhat elongated hemisphere or dome. *Surface* is shining, minutely pitted under the microscope and having 19 meridional tuberculate ribs which do not reach the bottom and lose themselves at about two-thirds the way up in knobs ; these ribs have the intervals between them cross-rayed, the intervals between the cross-rays being 0·02mm. ; the ribs are 0·01mm. thick and the greatest breadth between them is ten times that or 0·1mm. (this is of course at their lower ends) ; there are four tiny tubercles to each 0·05mm. length of rib. *Colour* slightly soiled-whitish or very pale honey-yellow with, sometime after laying, an irregular, blotchy, blood-red band round the middle and some separate ring-spots, also a patch on vertex made up of ring-spots and blotching of red. B : 0·65mm. ; H : 0·4mm.

Larva.—Is very similar to those of *Ampittia dioscorides.* The caterpillar's *head* is half-elliptical in shape, higher somewhat than broad with the surface rough-cellular and some hairs about the lower part round mouth-opening, the colour being green with yellow mandibles. The *shape* of the body is subcylindrical, thickest in middle or about segment 5 when at rest ; segment 2 not as broad as head, the neck still narrower ; anal end flattish, broadly rounded at extremity with some hairs on the free margin. *Surface* dull, under the lens covered with minute, erect hairs ; the segments all well marked. *Spiracles* very small disc-like, yellow, very round ; those of 2 much the largest. *Colour* light-green, glaucous-looking with darker green dots, the hair-bases ; a darkish dorsal, longitudinal line, a white, lateral, distinct, longitudinal line and an indistinct, subspiracular one ; two yellow bodies, one on each side of dorsal line, showing through the skin in the male. L : 19mm. ; B : 2.5mm.

Pupa.—Much the same *shape* as that of *Ampittia* ; the head square in front, eyes prominent, the frons with a short beak or conical boss or snout, porrectly pointing out in front ; thorax convex-humped ending somewhat abruptly behind ; segment 2 long, convex transversely, less inclined to the longitudinal axis of the body than front of thorax ; no constriction at 5 ; under the lens segment 4 is somewhat lower than 3 and 5 is again ever so little higher than 4, the front margin being provided in the dorsal line with a little point that is directed over 4 and under which passes the body-band that serves to keep the pupa against the surface it is fixed to by the tail ; wings very little thickened along inner margins behind the rounded shoulders ; the outline is straight on dorsum from thorax-end to cremaster ; circular in transverse section from shoulders to 13 ; segments 13 and 14 are exactly the same width to end of cremaster which is a thin, oblong piece with the extremity rounded and set with fine, white hairs. *Surface* set with extremely minute, erect hairs under the lens ; segments distinct. *Spiracles* small, oval, whitish, that of segment 2 with a rather large, broad, flush, yellow mark like a note of exclamation. *Colour* dark, semitranslucent green with a fine subdorsal and lateral, longitudinal, white line and an obscure spiracular one. L : 14·2mm. ; B : 2·9mm. ; snout 0·1mm. long.

Habits.—The eggs are laid on dead blades of grass or green ones, generally on the undersides. The larva makes a loose cell by joining the edges of the blade in a slovenly way, lying on the underside of the blade. It pupates in an open cell similar to those *Parnara* makes by just drawing the edges of the blade together but not joining them. The pupa is attached by the tail and a body-band. The hairs at the end of the cremaster of the pupa must have minute-hooked tips to fasten into the silk-pad. The butterflies are weak fliers, frequenting grass in the open places in the jungles but are difficult to see owing to their small size and to their comparatively fast flight. They rest on the ground or on leaves, etc., close to it ; never rise any distance from it and are fond of flowers upon which they feed, choosing such as grow amongst the grass, mostly leguminous. As a sort of example of the vicissitudes that attend the pursuit of breeding butterflies in India the following extracts from a diary of 1918 may perhaps be of some interest :—

Monday, September 9.—A dull morning ; it had been raining all the night

Walked and bicycled down the 1,500′ to the foot of the Gund Plateau and the remaining twelve miles or so to Sulgeri on the Kalinadi River. Collected various plants. . . . After we got in to the bungalow we went down to the river and looked in the grass for *Aëromachus indistincta* and after a bit, found there were a lot of them about—they are so small that, at first, before we became accustomed to them, we hardly saw one ; they fly fast and in long jerking, deviating way ; settling rather rarely except occasionally on flowers in the grass ; they do not often sit. Later on about 1 or 2 p.m., however, they settled much oftener and M. managed to catch three after vain efforts with a tumbler and a finger bowl, stalking them with great care and popping the thing over them on the ground. The servants brought no butterfly net with them so I sent back for one and a cage and to-morrow we hope to get a lot to breed from.

Tuesday.—After breakfast went out with the net that had arrived and managed to catch seven *Aëromachus* to put in the cage with grass for them to lay on. Hope to catch more to-morrow. The catching of these butterflies and determining plants took us until tea-time after 4 p.m.

Wednesday.—Got back to the bungalow at about 11 a.m. and found. Ibrahim had caught two *Aëromachus.* He had taken all the morning over it. So we set to work and caught fourteen in half an hour which we put into the cage. Then we had breakfast sandwiches, hard-boiled eggs, buns and cold coffee. After which we packed up everything. It was after 1. Went to Kadra in the afternoon.

Friday 13.—In the evening examined all the grass in the cage in which we had put the *Aëromachus.* They were all dead except one. There were, however, eight eggs laid by them. Leaving Karwar to-morrow for Dharwar and shall take an egg to describe ; leaving the others to be looked after here by Taku and Waman.

Thereafter Dharwar, Poona, Bombay, the influenza epidemic and a bad attack of that followed by dysentery brought the time up to November 20. On October 10 or about that date two or three butterflies of *Aëromachus* came out of pupæ resulting from the eggs laid in September. No more ; for Waman and Taku, the boys looking after breeding operations in Karwar, had got influenza and, although not badly, they were so frightened because of the reports of deaths everywhere in the Presidency that they neglected everything and, it appears, stayed at home in the village, lying down.

In the specimens caught that September and other captured since in N. Kanara District, many have the discal series of white scale dots on the fore wing (they are not semihyaline at all) very distinct while others have it absolutely wanting ; some have a white dot at the end of cell on the upperside of fore wing also. On the underside of the fore wing the discal series consists of one each in interspaces 1 to 8, the one in the first being sometimes hardly visible—on the upperside there are generally only the last 5 ; there is an indistinct series, submarginal, of three spots in interspaces 5, 6 and 7 : in the hind wing, similarly, the discal series consists of one in each of the same interspaces 1 to 8 with a submarginal series of 5 and a single one at end of cell. The fringe of hair along inner margin of fore wing is very slight ; the long decumbent, brown hairs in cell on upperside of hind wing and below cell are also very few.

Swinhoe informs us that the habitat of the butterfly is S. India, Ceylon, Burma, Java and Sumatra and that the type came from Salween, Moulmein, that Moore records it from Mergui ; Elwes from Bernardmyo, Tavoy in Burma and from Java ; de Nicéville and Martin from Sumatra ; Adamson from Toungoo ; Hampson from the Nilgiris, de Nicéville from the Palni Hills, Davidson, Bell and Aitken bred it at Karwar but unfortunately did not figure the larva and pupa ; and that he has it in his collection from the Ataran Valley in Burma and from Sumatra.

There are seven extra Indian species of the genus *Aëromachus* coming from Japan, W. China, Amurland (*inachus*, Ménétriés); from Thibet (*catocyaneus* Mabille) ; from Moupin, E. Thibet (*piceus*, Leech) ; W. China (*chinensis*, El. and Edw.) ; W. Java (*javanicus*, El. and Edw.) ; the Philippines (*musca*, Mabille) ; and from Shanghai, Ichang (*nanus*, Leech.)

A FEW DAYS AFTER URIAL OF THE PUNJAB

By Lt.-Col. R. W. Burton, I.A. (Retired)

The Urial of the Punjab (*Ovis vignei punjabensis*) is to be found in several localities, readily accessible to the sportsman in need of a few days holiday, and the pursuit of this handsome variety of the wild sheep of Asia can afford excellent sport and can, at the same time, furnish a handsome trophy—as an addition to the collection of heads of Indian large game.

Early in December 1920, the writer was able to avail himself of a few days' leave for a much coveted shoot in the Kala Chitta Range; and, at the same time, to see something of the wonders of the ancient city of Taxila, now under excavation by the Archæological Department of the Government of India.

On the way to Taxila, the motor car was stopped in a deep cutting above which is an obelisk erected to the memory of General John Nicholson. It occupies a fine commanding position and is visible for many miles. In the cutting on one side of the road is a fountain for drinking water and opposite to it are stone slabs, inscribed in English and Urdu, to the memory of the famous soldier. Proceeding along the Peshawar road, and turning off past the Railway Station of Taxila, the car took me to within half a mile of a large stupa the masonry work of which is of three kinds, dating to different periods, the earliest being about 300 B.C. Some of the stucco figures on this stupa are still in fair preservation. From this place, by a drive of some three miles, a visit was made to a monastery excavated out of the hill side. These buildings were, at the time of my visit, the most interesting and in the best preservation of all those hitherto exposed to view. The small carved figures surrounding the pedestals of some of the sculptures are very grotesque though wonderful in execution, illustrating in a most amusing way the strenuous efforts of men, monkeys, elephants, camels, oxen and other animals, in supporting the structure. Many of the sculptures are very beautiful with marked Grecian features.

Others of the widely scattered excavated buildings were seen, as also the extensive excavation, then under progress and by now no doubt greatly advanced, by which a whole city is being laid bare. The main street is about twenty-five feet wide, the side streets being some ten to fifteen feet in width and at right angles to the main road of the city. The rooms of the houses strike one as extraordinarily small. The earthenware pipes by which the city received its water-supply can be seen, much as they existed 2000 years ago. But all this is not urial shikar, and those of our readers who have seen these wonderful ruins at a later period of their exposure to modern eyes, and have also for reference a copy of Sir John Marshall's most interesting and informing handbook concerning this ancient city, will rapidly pass by these few very inadequate notes regarding it.

On arrival at the small wayside railway station, from which my shooting ground was not far distant, I was greeted by the news that on the previous evening dacoits—probably trans-Indus Pathans—had raided the railway station. The station buildings, including the quarters of the station master and his assistant, were seen to be completely gutted. The assistant was seated amidst the charred remains of furniture, busily ticking away at his telegraph instrument. The dacoits, having completed the work of collecting everything of any value to themselves, had piled all the furniture, drenched it with kerosine oil, and set the place on fire. The women of the two households had been obliged to make over all their gold and silver ornaments, but had not been otherwise molested. The old station master had received a punch in the chest from the butt end of a pistol.

The place was full of police, and I was escorted to the small bungalow, situated on rising ground some three hundred yards away, where I was to pass the night. When the gang, which consisted of only three or four men, was busy on the railway premises, one of their number went to this bungalow, occupied that afternoon by an Indian official who was travelling, on transfer, with his family. The young ruffian—he was said to be only about eighteen years of age—entered into amicable conversation with the official, and having learned all he could enquired whether a pistol was carried. The reply being in the negative he promptly produced his own weapon. Having obtained a large sum of money and all the ornaments of the women, he brutally shot the unfortunate man in three places, and made his way back to his companions. All this took place in broad daylight, the setting sun going down on the blazing buildings. The blood of the victim was fresh on the whitewashed walls, the plaster of which was scarred by bullets. Fortunate for me that I had not arrived twenty-four hours earlier : weapons in locked cases are not of much avail against the sudden appearance of a determined ruffian armed with a revolver. This gang was not, I believe, brought to book on this occasion ; but met with just deserts at a later period in consequence of further murderous outrages in the Attock District.

The next day an early start was made. The camp was found ready pitched at the foot of the hills, and two local shikaris, father and son, produced the usual assortment of chits. In the afternoon the rifle—·375—had to be tried at various distances, as a new batch of cartridges loaded with a—to me—new kind of powder (Moddite) had to be brought into use. It was found that the hundred yards sight was good for any distance up to 250 yards and more. This had been found to be the case with other cartridges in many parts of the hills and plains, especially with cartridges of foreign manufacture. Small bore rifles are mostly considerably over-sighted. Moddite proved quite satisfactory, but it is best to try and keep to one kind of powder and one maker. Every new batch of cartridges should, however, be tested with a few trial shots.

Leaving camp early next morning half-an-hour's walking found us—myself, the two *shikaris*, and a tiffin cooly—working along the lower slopes of the rocky and scrub-covered hills. Soon after daybreak—the rifle sights were as yet scarcely visible—a hissing sort of whistle, the alarm note of the urial, drew our attention to a couple of rams with horns of about 20 to 25 inches. They were above us and soon made off uphill.

After that first view of game, until leaving the hills at four in the afternoon, we were seldom out of sight of and must have seen over a hundred animals. Of all these, many of course being ewes, only about half a dozen had good heads: by which I mean horns of well over 30 inches. It was a great pleasure to watch these handsome game-like sheep with their reddish brown coats, dark saddle backs, and long beards. Unfortunately the rutting season was past, so those exciting battles between the rams could not be watched.

At one time, early in the day, I was within sixty yards of a fine fat fellow with fair horns. He was standing on his hind legs feeding on the leaves of a thorny tree. It was interesting to watch him, and those of his companions who were visible among the scattered thorn and privet bushes of the ravine. Suddenly they took alarm and galloped off up the opposite hill side. A slant of wind no doubt. Such a stampede! A number of them stood on a spur and gazed in our direction, presenting quite a small forest of horns. They were only a hundred yards away and stared for quite a long time.

About twelve o'clock a halt for 'lunch' was made. Packing up was nearly done when the old *shikari* hastily signalled to me. A number of urial were coming up the slope from the valley below and would soon top the ridge to our side. Almost before the rifle could be got ready the first comers arrived amid much clattering of stones. Several sheep of both sexes appeared, paused to stare, and dashed off up the ravine. Then came a ram with horns of massive appearance. Evidently he was the owner of a fine head. He halted exactly where the other animals had paused and a quickly-sighted right shoulder shot at 120 yards dropped him where he stood. This was a somewhat fortunate shot, as my right eye is not in class A 1, but for very quick shooting it must needs be trusted. A great aid to quick aim is a tin funnel, fitted over the backsight, by means of which it is in constant shadow and all glare cut off. This was the best head of the trip, and the owner of it was named '*Itifak*' on account of his chance appearance on the scene. The horns presented almost a perfect circle, the tips touching the hair of the cheek bones. Right horn 34½ inches, left 33 inches, the circumference at the base being 10½ inches. The beard was mostly white and the photograph taken was an excellent one.

After this, within half an hour, another good head should have been secured. The sun being in my eyes, and the beast in shadow, a miss was scored over the top of his back. Perhaps, also, I was a bit too hurried as the urial were on the move. One must sometimes make excuses for such happenings.

During the past few days there had been a very keen wind and I must at some time have exposed myself without being aware of it. All day there had been a feeling of being chilled and this, in spite of a warm vest, flannel shirt, cardigan waistcoat and puttoo coat! A rising temperature and aching legs warned me to be off to camp which was reached about five o'clock. Suitable treatment enabled me to shake off the threatened attack of fever, so fears of the shoot being cut short proved unfounded. In the evening the younger *shikari* brought me a pigeon, minus its head, which I identified as the Indian Stock Dove. He had killed it with a stone. A number of these birds were round about camp, also some coveys of chukor.

Next morning all the aches and pains were gone and a start was made by seven o'clock. A bitterly cold wind was blowing from the north, where snow-covered hills could be seen in the far distance. By half-past eight four rams, all about 25 inches, were seen and after that until past midday, nothing but one small ram and some ewes. Probably most of the animals were sheltering among the bushes and in the ravines. Gradually we made our way to the highest part of this portion of the range, where there is a white rock called 'Chitta'. The whole range bears the name of Kala Chitta. The old *shikari* says there is a black rock at the other end of this range of hills, hence the name: may be so. Soon after leaving 'Chitta' some urial were sighted far below, down the slopes of a wooded ravine, and the telescope disclosed that the gentleman of the party was a white-bearded old fellow the possessor of what seemed to be a perfect head of 32 or 33 inches. The line of approach was down the reverse side of a very rocky and precipitous ridge, and we eventually found ourselves a bit above the patriarch who was on the opposite ridge, about 200 yards away, and partly hidden by a bush. Our descent of the hill had not been entirely noiseless and the animals were evidently on the alert. There was no time to be lost, so a sitting position was quickly gained under cover of a small rock. The shot went over or else the beast was killed, as he instantly disappeared: but I knew it must have been a miss. The strenuous climb down had made me shaky. After going to see whether, by any chance, the animal had been hit, we rested for a while and a much-needed meal was discussed. The next move was to work across the neighbouring ravine to another ridge. From there the keen-eyed shikari drew attention to a white speck far up the hill and the telescope disclosed to view another patriarch, quite possibly the same beast recently missed. He was a long way off in a small open space among the shrubs with which the hill side just there was thickly covered. Viewed through the telescope he made a handsome picture. He was lying down with head erect, facing exactly towards me, his horns forming a perfect circle on either side while his long white beard was very conspicuous. It was this patch of white among the green which gave him away: a younger animal, with a black beard, would probably have escaped notice.

Leaving a man on the watch and giving him a whistle, we recrossed the ravine to make our way up the reverse side of the spur to that on which the former animal had stood when I missed him.

Then one of the men was sent higher up to disturb the ram, as it was hopeless to attempt to get near him where he lay. The *shikari* and I also climbed higher up to a place where the valley was fairly clear of bushes. No warning whistle came to us from below, but we had hardly got there, and I had only just selected a place on the steep hill side on which to sit, when a clatter of stones announced an animal travelling at speed and a ewe was seen to cross the bed of the ravine and make her way diagonally across the opposite slope of the hill. This gave the probable line of retreat for the remainder. Soon some other ewes appeared and then the ancient one. He crossed the *nala* out of sight, going fast, but halted—a fatal pause—in an open space on the opposite side of the valley. A good and quick shot from the left shoulder took him at 200 yards through his right shoulder. Stone dead, he slithered down the slope until fetched up by a small shrub. So much was he dead mutton that he could not be *hallaled*. He proved to be a very old animal, several teeth gone, hair turning white on shoulders and rump while his beard was quite white. The saddle on his back was very clearly marked. Horns 31 inches only. They had seemed bigger than that. However he was a fine trophy and well deserved. '*Dada*' was the quite appropriate name given to him by the men.

The third day new ground was tried and many urial were seen. Early in the morning a good beast was missed. The approach was not too easy: it was necessary to crawl some distance and be careful to keep in shadow of bushes as no animals have more keen eyesight than the ever-watchful wild sheep. The twigs of green privet stuck in my sun topee enabled a sitting position by side of a bush to be slowly gained. Alas! I had omitted the morning routine of wiping out the oiled barrel and a high miss was the inevitable result—the ram gave no second chance. On the shot being fired two other rams ran back towards me and walked across our front at close range, without detecting us, as we crouched crouched motionless admiring their stately paces. The next valley was bare of cover, containing only a few small gatherings of sheep with no shootable ram among them. A long climb took us to a high ridge, on the other side of which was a deep and precipitous ravine. Urial could be seen some distance away; but the wind was wrong, and the only thing to do was to send a man round and above to give them his wind and so enable the telescope and field glasses to get to work. This was done and from where merely a few animals lying down had been seen a long procession of sheep now came into view. There were some fair heads in this large flock of nearly a hundred animals, but none of outstanding size. One of the ewes was obviously a tame sheep strayed who now ran bleating loudly with her wild sisters. Slowly following the long procession—the '*Rissala*' the men called it—appeared two splendid looking rams. Evidently but little alarmed, they branched off by themselves and lay down, out of shot, under a thorny tree. After a wait of over an hour some urial came from below and, going upwards, climbed towards the big fellows who had meanwhile got up and, with frequent halts, were coming along towards them and so nearer to us. When the lower party, slowly pacing, suddenly caught sight of the heads of the veterans, or, perhaps, merely heard the slight noise of their movement, they got a great scare and wildly bolted in the opposite direction. The two old gentlemen came quietly on. Foolishly becoming nervous as to the distance, which, owing to the deep and wide intervening ravine was not easy to judge, I put up the 200 yards leaf and twice went over the back of the larger one of the pair. There was not much to choose between them. He turned uphill, and the third shot, aimed much lower, got him through the body and pulled him up short ; a fourth bullet broke his neck. The man up the hill came flying down, at such a pace as only these hill men can attain, his knife glittering in the rays of the sun, now getting low in the sky, and on reaching the ram called out that he was dead. '*Hallal karo, Hallal karo*' yelled the three men with me and this was done amid great reverberating shouts of '*Allaho Akbar*' from our side. This patriarch also had an almost wholly white beard. His horns were 32 inches being very symmetrical and massive. The tips were worn and not broken. He was ironically named the '*Sipah Salah*' on account of his having taken up a strategic position, with his 'Adjutant-General' in attendance. This was the suggestion of the man added to our party this day and who had done some military service.

We were far afield, camp was not reached until dark and the unfortunate '*Sipah Salah*' was pronounced by the village mullah to be unlawful meat as he had no breath in him when *hallaled*. This was certainly the case as his neck was broken : but if blood flows that should suffice. However the strict Muhammadans of this part of the country will not allow even that small latitude in the matter. This mullah had a fine voice and it was most impressive to hear his sonorous call to prayers ringing out over the country side, especially in the early hours of the coming day.

This long day's work over the knife-edged rocks and rough stony hills completely finished the new rope soles with which the shoot was commenced. I took to the *chapli* of the country after this, and also when in the Salt Range where the going is even worse than in the Kala Chitta Hills.

There was said to be an albino ram in this part of the range, 'white as your handkerchief' the shikari described him. Much to my regret he was not seen. On the way back to camp that day we came down a rocky ravine which somewhat reminded me of an immense gorge lately seen in a side valley of the Sutlej River, far up on the Tibet border, where huge pieces of the hill side had been displaced by a recent earthquake : so said the local people. Telling the men of this they enquired the cause of earthquakes which was explained to best of my ability. I was then informed that the mullah's explanation was that a big bull supported the earth on his horns, one horn at a time, and the earthquake occurred when he got tired, which was at very long intervals, and had to change the weight from one horn to the other ! Perhaps the jovial fellows were pulling my leg.

The fourth day of this most enjoyable outing was a day of misses ; very suitably, *four* misses ! A fine ram was found at about eleven o'clock and missed at some 220 yards : a down hill shot. Later on a real good head was seen. After a long stalk, very skilfully conducted by the younger *shikari*—the old man was bowled over by raging toothache—a shot was obtained on the opposite side of a ravine, at a beast which I took to be the animal we were after. The lad said I went over him. Just after firing this shot there was a slight noise behind us and there were half a dozen rams with *the* big one among them ! They were watching curiously, wondering no doubt why we were crawling about, and made off rapidly to quickly disappear among the many rocks and bushes. The big ram was not again seen. Much ground was covered and yet another miss at a good ram. Still over the top says the shikari. On the way to camp the remains of an urial, evidently killed some days previously by a panther, were found. Doubtless the few panthers which inhabit those hills take full toll of these wild sheep and are seldom in want of a meal.

Discouraged by want of success we slowly picked our way by descending paths. The bearer of a shootable head was spied far down the hill and the stalk resulted in yet another miss ! my 'little Mary' was somewhat uneasy and may be that affected my shooting during this day. A number of good heads had been seen ; the best of them about 33 inches.

It seems however, that the real reason why there was no success in that day's shikar was, that we met an old woman on leaving the village in the morning ; and one of the coolies saw a hare. With two such bad omens how was it possible for the rifle to hit anything ? Had a jackal been seen matters would have been entirely different ! In Kashmir also it is considered very unlucky if women are met when men are setting out for shikar.

On the last morning, the fifth day of the shoot, a fox was seen ; not good, but later on a jackal crossed our path and this counteracted the former malign influence so we soon sighted urial. The stalk was not difficult as there was an icy wind and the animals were all sheltering from it in a ravine. The only ram of any size proved to be certainly under 30 inches. A stone thrown down the hill side moved these animals and also some others which had been lying up, unseen, on our side of the ravine. They soon came into view. One ram appeared to bear a good head and the shot, taken tail on at 120 yards, took him at the place aimed at, the centre of the left buttock, travelling forward to the chest, and he only moved a couple of yards. This time the meat was 'lawful'; very much so quite judging by the shambles the men made of the place. An old beast he was, turning grey as to beard, but not, a 'patriarch'. His horns were very much broken at the tips, and also at the bend, probably in fighting, and as he was evidently something of a bruiser they named him '*Pahlwan*'.

Four heads 34½″, 33″, 32″ and 30″ had been obtained, enough indeed, and no more could be shot. The old shikari, who had hunted urial of these hills for thirty years, told me he only once saw a head of 36 inches, and that in 1918. Anything of 32 inches and over is quite good, and I was fortunate in the heads I secured. Protection appears to have come into force about twenty years ago, and to have been much needed, as urial were becoming scarce. The men said there was a good deal of poaching going on in some parts, also grazing of cattle and goats, so disturbing to the sheep, but that the forest guards were powerless in the matter. That can be readily imagined. The people of these parts are not of the most law-abiding in the land. On a later occasion I again visited this locality but saw no heads better than that of '*Pahlwan*'; perhaps the sheep had moved ground, or the grey-beards been shot by other sportsmen.

The urial of the Salt Range are smaller animals than those of the Kala Chitta Hills both as to bulk of body and size of horns. I saw nothing there over 26 inches. Probably the more arid nature of the country and the inferior feeding has something to do with the matter. Animals were not plentiful and as strict protection as it is possible to attain seemed indicated, in the block I was shooting in at any rate, and probably in the other blocks as well. This was in 1923. Chinkara with heads running to 13 inches are to be found in the Salt Range and in some places chukor, see-see, and grey partridges are plentiful. The walking is atrocious.

On my way from camp to railway station, the old *shikari* accompanying me as I was taking him to a doctor who would extract the offending tooth,—a chinkara with horns 11½ inches in length afforded a somewhat difficult stalk which ended in a successful shot at about 180 yards. A few others were seen, all of them very wild, and so the blackened ruins of the station were gained by sun down and this most pleasant and successful outing came to an end.

My train was due to leave at 4 a.m., and I had a somewhat restless night on the station platform, one of my awakenings being due to the rumbling arrival of a bullock cart bringing the coffin containing the mortal remains of the unfortunate victim of the dacoity. He had died that morning and his body was being conveyed to his native place in the same train by which I was to travel, a coincidence which occasioned sundry sober reflections as to what 'might have been.'

INDIAN DRAGONFLIES

BY

MAJOR F. C. FRASER, I.M.S., F.E.S

Part XXII

(With one plate and 3 text-figures.)

(*Continued from page 663 of Vol. XXX.*)

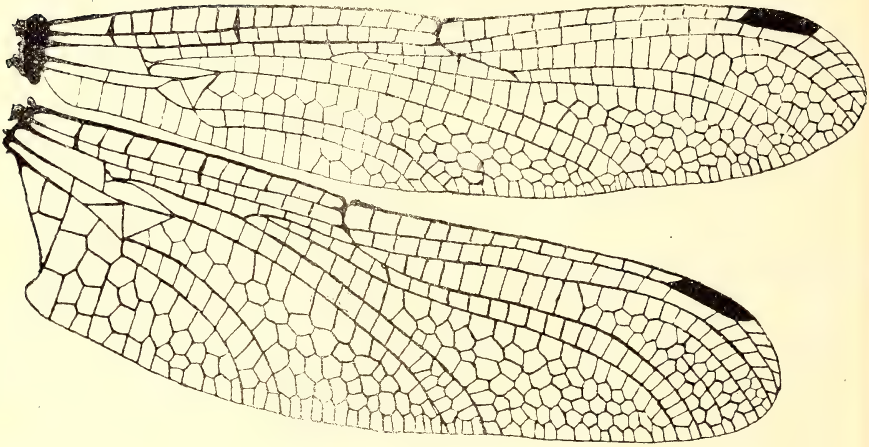


Fig. I—Wings of *Heliogomphus promelas* (Selys.) Male

Genus—HELIOGOMPHUS Laid

Insects of moderate build, limited to the Oriental Region, all very similar in appearance, coloured black marked with bright greenish yellow.

Venation moderately close; wings long and narrow, base of hindwing oblique, approaching that of *Anisogomphus*; pterostigma small, less than one-third the length of distance between node and distal end of pterostigma, rarely braced and then only imperfectly so; basal incomplete antenodal nervure absent; arc usually between the second and third antenodal nervures or more rarely opposite the second; sectors of arc approximating to each other immediately after their origin, and in some wings, of individual specimens, actually fused for a short distance as in the *Libellulinae* (but there is always a short separation after their origin); 1 to 2 cubital nervures in all wings; only a single row of postanal cells in the forewing, 3 to 4 in the hind; first postanal cell of hindwing always entire, small, not nearly extending to proximal angle of subtrigone; 5 to 6 traversing nervures between *Mi-iii* and *Miv* in forewing, 3 to 4 in the hind; forking of *Mi-ii* and *Miii* in both wings unsymmetrical; only a single row of cells between *Mi* and *Mia*; 3 to 4 rows of cells in discoidal field at level of node in the forewing; only two rows of cells posterior to *Cuii* in the same wing, this nervure being flat or only slightly pectinate; trigone moderately elongate, its costal border in the hindwing nearly twice the length of base, entire in all wings.

Head very narrow from before back, very wide from side to side, almost Zygopterous in shape, that of the female especially, bearing a strong resemblance to a female *Pseudophaea*.

Legs rather long, hind femora extending to apical border of segment one, or slightly overlapping segment two ; in the female armed with two rows of rather widely spaced, evenly-sized, rather elongate spines. (Somewhat similar to those of *Indogomphus*.) In the male, the femora armed with rows of very minute, very closely set spines.

Abdomen of male tumid at segments 1 and 2, thin and cylindrical from three to the proximal end of seven, the apical half of the latter and segments 8 to 10 evenly and rather widely dilated laterally and dorso-ventrally. Abdomen of female cylindrical and of even width throughout.

Genitalia prominent, vesicle rather large, hamules small. Vulvar scale small and rudimentary. Anal superior appendages lyrate, inferior cleft.

Distribution. Assam, Burma, the Western Ghats of India, Ceylon, Java, Indo-China and Borneo.

Genotype.—*Heliogomphus nietneri* (Selys).

Heliogomphus nietneri (Selys) (*Leptogomphus nietneri*) (*Gomphus nietneri* and *Anisogomphus ? nietneri*) Bull. Acad. Belg., (2), xlvi, p. 449 (1878) ; Kirby, (*Anisogomphus nietneri*), Cat. Odon. p. 69 (1890) ; Will. Proc. U. S. Nat. Hist. Mus., vol. xxxiii, p. 295 (1907) ; Laid. Rec. Ind. Mus., vol. xxiv, pp. 379–380 (1922) ; Fras. Rec. Ind. Mus., vol. xxvi, p. 416 (1924.)

Male. Abdomen 35 mm. Hindwing 30 mm.

Head. Labium pale yellow, middle lobe bordered with brown ; labrum glossy black marked with two moderately broad, closely apposed, bright citron yellow spots ; face black, frons traversed by a broad stripe of greenish yellow which slightly overlaps the foreborder ; vertex black, occiput yellow in its anterior third, black posteriorly, depressed, its crest slightly elevated, fringed with short black hairs.

Prothorax black with a broad anterior collar of greenish yellow.

Thorax coal black marked with greenish yellow as follows :—A slender mesothoracic collar, slightly interrupted at its middle, a narrow oblique antehumeral stripe not confluent below with the collar, nor extending up as far as alar sinus, pointed below, squared above ; a small upper humeral spot. Laterally the sides greenish yellow marked with two broadish black stripes, the anterior one the broader, the posterior nearly terminal. Beneath pale yellow. (The position of the hinder stripe as given by Selys seems to me rather doubtful and is more probably situated along the lateral suture.)

Legs black, femora brown within and outward at the base.

Wings hyaline, costal border finely yellow ; 2 cubital nervures in the forewing ; anal border of hind very oblique ; pterostigma yellow, 2·5 to 3 mm. slender, over $3\frac{1}{2}$ cells, not braced ; membrane absent ; nodal index 16/17 antenodals, 14 postnodals.

Abdomen with large rounded oreillets on the second segment, bearing minute black denticles along the hinder border. Abdomen black marked with bright yellow as follows :—Segment one with a triangular dorsal spot, segment two with a bilobed dorsal spot, 3 to 7 with only the dorsal carina finely marked, but segments 6 and 7 with larger basal spots, the sides of segments 1 and 2 broadly yellow, 3 to 8 with baso-lateral spots tapering apicalward, 8 and 9 with apico-lateral spots, 10 unmarked.

Anal appendages. Superior 1·5 mm. long, rather longer than segment 10, white turning to brown at the tips, flat and very broad as seen from above, converging at extreme base, turning at first out and then in, so as to enclose a minute foramen, the tips nearly touching, an outer tooth near the base, expanding immediately after this and with the extreme tip turned up and out. Laterally the appendage thickened at its middle, truncate at the end, the tip rising almost perpendicularly. The two appendages are lyrate and may be likened to the curling horns of a cow.

Inferior appendage only about half the length of superiors, broadly cleft and forked, the tips of its branches projecting latterally from beneath the superiors.

Habitat. Ceylon in montane or submontane areas such as Rhambodah. The type, a male, is the only specimen known of this insect, but I have a single male in my collection from Kallar, South India, which seems to fall midway between this and the next species to be described. Type in the Hagen collection.

Heligomphus promelas (Selys) (*Gomphus promelas*) Bull. Acad. Belg. (2), xxxv, p. 759 (1873) ; Kirby (*Aeshna promelas*), Cat. Odon., p. 68 (1890) ; Will. Proc. U.S. Nat. Hist., l.c., p. 305 (1907) ; Laid. l.c., p. 398 (1922) ; Fras. l.c., pp. 416–417 (1922), and p. 473 (1924), (*Heliogomphus pruinans*).

Male. Abdomen 42 mm. Hindwing 32 mm.

Head black marked with yellow ; labium yellowish brown ; labrum black marked with two basal greenish yellow spots whose opposing borders are concave ; mandibles greenish white ; face black, the frons marked above with a greenish white transverse stripe ; occiput black, depressed ; eyes bottle-green.

Prothorax black, the posterior lobe, a geminate spot in front of it, and an anterior collar yellowish green, beneath pruinosed white.

Thorax black on the dorsum, greenish yellow on the sides marked as follows :—A complete metothoracic collar, short antehumeral stripes not quite reaching the alar sinus above and not nearly reaching the mesothoracic collar below, parallel with the middorsal carina. Laterally the two sutures mapped out in black. Beneath and below pruinosed white, especially in very adult specimens.

Legs black, the hind femora armed with a row of very closely-set, very small spines.

Wings hyaline, occasionally slightly enfumed ; pterostigma blackish brown, very rarely braced and then only poorly so and not usually in more than one or two of the wings ; only a single cubital nervure to all wings ; costal side of trigone of hindwing twice as long as the basal ; nodal index $\frac{11\text{–}15}{12\text{–}11}\Big|\frac{15\text{–}12}{12\text{–}12}$, other points as for genus.

Abdomen black marked with pale greenish yellow as follows :—A narrow middorsal stripe extending from segment 1 to 5, thickest on 2 where it may be lobulated, a large lateral spot on segment 1 and a similar, but larger one, on segment 2 which envelops the oreillett, small baso-lateral spots on segments 3 to 6, growing progressively smaller as traced from segment to segment, 7 with a ring occupying about its basal third, lastly an occasional dorsal spot on segment 8, remaining segments entirely black.

Anal appendages lyrate as for genotype. Superiors black at base, pale green to yellow at apices, which curl first in, then out and up. Inferior black.

Genitalia : lamina very depressed, deeply bifid, hood-shaped ; inner hamules narrow, stillete-shaped, pointed ; outer much more robust, elongate, the inner side of apex curling slightly up ; vesicle of penis black, globular, rather prominent, its upper border narrowly but rather deeply notched.

Female. Abdomen 39–42 mm. Hindwing 35–38 mm.

Very similar to the male but more robust. Occiput simple, depressed. The antehumeral stripes rather longer and sometimes confluent at a point with the mesothoracic collar. The yellow spots on the sides of abdomen more extensive, those on 3 to 6 extending from base to the transverse suture and on 3 to 5 continued after a short interruption as an elongate spot which does not quite reach the apical border of segments. On segment 6 there may be a vestigial medio-lateral spot.

Legs with longer spines on the femora. Vulvar scale triangular, extending for about one-third the length of segment 9, glossy black.

Wings usually distinctly saffronated at the extreme base, broader, nodal index $\frac{12\text{–}15}{13\text{–}11}\Big|\frac{15\text{–}11}{12\text{–}13}$. Anal appendages black with inner yellow stripe.

Distribution. Nilgiris, Coorg and Kanara. I described this species from a single pair taken at Burliyar, Nilgiris, South India, 1,500 ft., 29, vii. 21, under the name of *H. pruinans*. Subsequently whilst endeavouring to place *Gomphus promelas* Selys, which was described from a single female from 'Madras', I was struck by the extreme improbability of such a species being taken at sea-level, and conjectured that the Presidency and not the city had been meant for the locality given.

Knowing that most of the types of Odonata coming from the presidency had been taken in the Nilgiris, I read over the description with all female Gomphines coming from the Nilgiris and found that it compared exactly with *H. pruinans*.

As the old Ghat Road by which all Madras civilians travelled to the Hills, traversed the bed of the Burliyar river at the spot where I had taken *H. pruinans*, I have little doubt but that the type of *promelas* was taken at the same spot.

The insect is comparatively rare in the Nilgiris, but is equally common in Coorg, especially in the river running through Hallery Estate, six miles from Mercara, 3,000 ft. It also breeds in the upper course of the Sampaji river, Mangalore Ghat.

Heliogomphus ceylonicus (Selys) (*Gomphus ceylonicus*), Bull. Acad. Belg. (2) xlvi, p. 455 (1878) ; Kirby, Cat. Odon. (*Aeshna ceylonica*), p. 68 (1890) ; Will. l. c., p. 305 (1907) ; Laid. l. c., p. 399 (1922).

Male. (Female unknown) Abdomen, 41 mm. Hindwing 39 mm.

The close resemblance of this species to the female of *promelas*, and the unbraced character of the pterostigma places it without doubt in genus *Heliogomphus*. Although clearly very closely related to other species, it differs in so many respects that it deserves to retain its specific rank.

Head, labium pale brown ; labrum black marked with two basal yellow spots ; base of mandibles yellow ; ante- and post-clypeus black, the latter with a medial yellow spot and another on each side against the eyes ; frons black with its crest broadly yellow ; upper surface of head black including the occiput, which is fringed with long, black hairs, is slightly raised in the middle in a small, triangular obtuse point and has six teeth near the eyes, finally a rough tubercle behind. Back of eyes glossy black with a spot of bright yellow at the middle. (Prothorax undescribed.)

Thorax black marked as follows :—A broadly interrupted mesothoracic collar, narrow, oblique antehumeral stripes not extending as far as the alar sinus above or the mesothoracic collar below, a small upper humeral spot. Laterally greenish yellow marked by two narrow-black stripes on the lateral sutures. All these stripes confluent below at the trochanters.

Wings hyaline ; pterostigma large, broad, pale yellow (possibly teneral), 3-4 mm. long, over 3-4 cells, unbraced ; nodal index 14-16/16-14.

Abdomen shaped as for genus, black marked with yellow as follows :— A fine middorsal line running from segment 1 to 6 tapering apicad on segments 1 and 2, finer on remaining segments and not extending quite to apex of segment 6. Segment 6 with a broader and basal marking. The sides of 1 and 3 broadly yellow, 4 to 9 with small baso-lateral spots, a larger one on each side of 7.

Legs black, armed as for genus.

Anal appendages and the conical protuberance between them black.

Distribution. Ceylon. A single female from the Rhambodah Pass, collected by Mr. Nietner. Selys remarks that the species is closely related to *promelas*. The differences between this and other species are tabulated below.

Heliogomphus walli sp. nov.

Female. (Male unknown). Abdomen 38 mm. Hindwing 36 mm.

Head, labium dark yellow, the lobes tipped with brownish black ; labrum black with two large triangular yellow basal spots ; rest of face, frons and upper surface of head black save for a narrow yellow stripe on crest of frons, which is narrowly interrupted at its middle. Occiput simple, naked ; back of eyes glossy black, unmarked with yellow.

Prothorax black, a narrow anterior collar yellow.

Thorax black marked with yellow as follows :—A very deep mesothoracic collar not interrupted at its middle, very short oblique antehumeral stripes widely separated from the alar sinus above and from the mesothoracic collar below ; no upper humeral spot. Laterally the sutures narrowly mapped out in black.

Wings hyaline, very palely enfumed ; pterostigma blackish brown, over 4½ to 5 cells, poorly braced in two wings, unbraced in the others ; nodal index $\frac{13\text{-}16 | 17\text{-}14}{13\text{-}11 | 12\text{-}12}$; 2 cubital nervures in three of the wings, 1 in the other (hindwing) ; sectors of arc fused for a short distance at origin ; three rows of postanal cells in hindwing.

Legs black, hind femora dark yellow, paler within, armed as for genus.

Abdomen black marked with yellow as follows :—Segment 1 with a broad triangular apical spot on dorsum and the lower part of the sides from level of oreillet ; 3 to 6 with the middorsal carina finely yellow and a broadish yellow stripe on the ventral border, which is interrupted slightly by the transverse suture on segment 4, more widely so on segments 5 and 6, segment 7 similar, but both dorsal and lateral stripes considerably broader, the baso-lateral part of stripe expanding into a spot ; remaining segments unmarked.

Anal appendages pale yellow, small, conical.

Vulvar scale barely one-third the length of segment 9, triangular, slightly bifid at apex, black. (A few eggs attached to it are pale yellow, narrow, oval and with rounded ends.)

Distribution. A single female collected by Col. F. Wall, I.M.S. at Nalande, Ceylon, 10. ix. 24. Type will be deposited in the B. M.

Closely related to *ceylonicus*, *nietneri* and *promelas*.

Heliogomphus selysi, sp. nov. (*Leptogomphus nietneri*) Selys, *Odonates de Birmanie*, Ann. Mus. Civ. Genov., xxx. (1890) ; Laid. (*Heliogomphus nietneri*), l. c., pp. 379, 380 (1922).

Male. (Female unknown). Abdomen 32–35 mm. Hindwing 28–30 mm.

Head, labium dark yellow ; labrum glossy black with two small triangular basal whitish green spots ; bases of mandibles greenish yellow ; rest of face, frons and upper surface of head black save for a transverse stripe of yellow on crest of frons constricted at its middle.

Occiput simple, low, slightly convex, fringed with short hairs.

Prothorax black, a geminate spot in front of posterior lobe, a small lateral spot and a narrow anterior collar of yellow.

Thorax black, marked as for *promelas*, the mesothorocic collar usually finely interrupted.

Legs black, armature of femora as for genus.

Wings hyaline ; nodal index 11–16/15–12 ; 2 cubital nervures in all wings ; pterostigma short, over 4 to 5 cells, dark brown.

Abdomen black marked with greenish yellow as follows :—A fine dorsal stripe from segment 1 to 6, becoming very obscure on segment 4, and variably present or absent on 5 and 6. Laterally segments 1 and 2 including the oreillets broadly yellow, a baso-lateral spot on segment 3, remaining segments unmarked.

Anal appendages. Superior yellow or in some specimens blackish brown at the base, pale yellow thereafter, the outer tooth at the base more robust than in *promelas*. Inferior black, as for *promelas*.

Distribution. The type is a male from Leito, Burma, collected by Mr. Fea and now in the Selysian collection. A pair belonging to the same species in the Indian Museum Collection, Calcutta, collected by Dr. Kemp (No. H7977/Hi), from the Garo Gills, Tura, Assam, 1,500 ft., have been described by Laidlaw, who expresses doubt as to whether they are really conspecific with *nietneri*. Mr. T. Bainbrigge Fletcher has also taken this insect on the Gauhati road near Shillong, Assam, 1000 ft., 2. viii. 19. This species appears to be the sole representative of its genus in Northern India and Burma ; it is easily distinguished from all others by the total absence of abdominal markings after segment 4. In the following table, the specific points of all five species are shown:—

Heliogomphus nietneri (Selys). Upper humeral spot present, which character it shares with the next species ; 2 cubital nervures, and well-marked lateral abdominal stripes as far as segments 8 or 9.

Heliogomphus ceylonicus (Selys). Upper humeral spot present, a lateral spot on the postclypeus (only present in this species), and the mesothoracic collar broadly interrupted.

Heliogomphus selysi sp. nov. Has the transverse stripe on crest of frons constricted at its middle, the mesothoracic collar interrupted, no lateral yellow markings after segment 3 and no markings whatever after segments 5 or 6, lastly there are 2 cubital nervures in all wings.

Holiogomphus promelas (Selys). Mesothoracic collar interrupted or entire, antehumeral stripes very long, longer than in any other species of the genus and occasionally even confluent below with the mesothoracic collar, lastly segment 7 with a broad basal yellow ring (only present in this species).

Heliogomphus walli sp. nov. Has the lateral abdominal markings very well developed as far as segment 7, none on segments 8 or 9, the mesothoracic collar unusually deep and broadly confluent, the hind femora dark yellow, paler within (the only species in which the legs are not entirely black), 2 cubital nervures in most wings, lastly the transverse stripe on crest of frons interrupted (the only species in which it is so.)

Genus—MICROGOMPHUS SELYS.

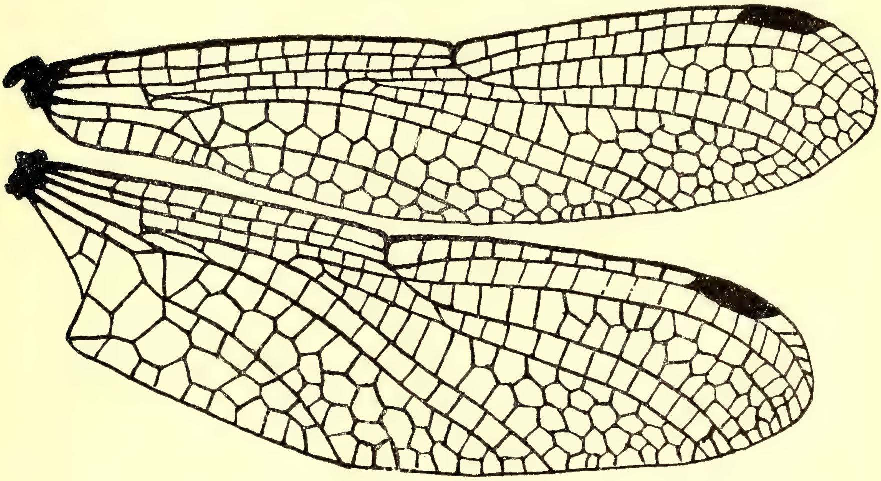


Fig. 2.

Fig. 2. Wings of *Microgomphus torquatus* (Selys) male.

Insects of small size, the smallest within the family *Gomphidae*, breeding in streams in submontane areas in the oriental region.

Venation. Wings of moderate length, narrow ; reticulation close ; base of hindwing very oblique, shallowly excavate ; costa uncoloured ; pterostigma braced or only poorly so, about one-fourth the length of distance between the node and distal end of pterostigma ; incomplete basal antenodal nervure absent : arc between the first and second antenodal nervures ; sectors of arc approximated immediately after their origin ; 1 cubital nervure to all wings ; 1 row only of postanal cells in forewing 2 to 3 in the hind ; first postanal cell in hindwing entire, extending basad for only about half the length of subtrigone ; 5 to 6 transverse nervures between *Mi-iii* and *Miv* in forewing, 3 to 4 in the hind ; forking of *Mi-ii* and *Miii* unsymmetrical in all wings ; 1 row of cells between *Mi* and *Mia* ; 3 rows of discoidal cells in forewing at level of node ; *Cuii* slightly pectinate, one or two rows of cells between it and hinder margin of wing in the male, 2 in the female ; trigone of hindwing subequilateral, costal and basal sides almost equal, proximal side often slightly but distinctly angulate—this character also being shared by the trigone of the forewing ; all trigones entire.

Head narrow from before back, transversely elongate, but not to the extent seen in *Heliogomphus*.

Legs slim, moderately long, overlapping base of second segment, armed in the male with rows of very closely-set, very minute, evenly-sized spines (serrate), in the female with robust, widely-spaced, rather long, sub-equal spines (pectinate.)

Abdomen tumid at the base, very slim and cylindrical from 3 to the apical end of segment 7, slightly widened and dorso-ventrally expanded from the apical half of 7 to 10.

Anal appendages. Superior chelate, rather widely divaricate, with an inner branch which gives them the chelate appearance, longer than segment 10 ;

inferior variable, slightly or much shorter than superiors, slightly bifid at apex or subtriangular with subacute apex.

Genitalia. Hamules rather long, vesicle of penis tumid, approaching that of *Cyclogomphus* but not nearly so exaggerated. Vulvar scale well-defined, triangular, extending for nearly half the length of segment 9, the extreme apex bifid.

Distribution. Throughout the oriental region, in regions of heavy rainfall, in montane and submontane areas only. Within Indian limits from the Western Ghats and west of the Deccan, Burma and Assam.

Species of this genus are arboreal by nature, but they often descend to settle on rocks in the bed of their parent streams, from which, when disturbed, they rise to the branches of trees high overhead. Settled in such situations, their shagreen colour renders them remarkably inconspicuous. Flight although short, is swift.

Genotype.—*Microgomphus chelifer* Selys. (Malaysia.)

Microgomphus torquatus (Selys) *Cyclogomphus torquatus*, Bull. Acad. Belg., xxi (2), p. 63 (1854) ; Kirby (*Cyclogomphus torquatus*), Cat. Odon., p. 69 (1890) ; Mon. Gomph., p. 108 (1857) ; Will (*Cyclogomphus torquatus*) l. c. p., 297 (1922) ; Laid. (*Microgomphus torquatus*) l. c., pp. 380–383 (1922) ; Fras. l. c., p. 474 (1924).

Male. Abdomen 22-24 mm. Hindwing 21 mm. (Pl. fig. 4.)

Head. Labium yellow ; labrum greenish yellow, the base and front border narrowly black, the basal marking produced as a triangular mark in the middle line ; frons, bases of mandibles, ante and post-clypeus greenish yellow, the frons with a broad black transverse stripe where it joins the postclypeus and sending downwards a short oblique submedial prolongation on the postclypeus at either side ; vertex and occiput black, the latter with a low, slightly concave crest which is bordered with about ten minute spines.

Prothorax black with an anterior collar, a small medial spot on the posterior lobe and a larger spot on each side yellow.

Thorax black marked with yellow as follows :—A complete mesothoracic collar which is confluent with a fine line of yellow on the lower part of the middorsal carina, a very oblique fusiform antehumeral stripe not confluent with the mesothoracic collar, nor reaching the alar sinus above. An upper humeral spot which splits the humeral black above so as to form an upright black 'Y'. Laterally greenish yellow marked by a black stripe on the posterior suture, which is joined at its middle by a narrow oblique black line descending from beneath the forewing and is thus converted into a second black 'Y'.

Legs black, the hind femora striped on the extensor surface with greenish yellow which tapers apicad, hind femora armed as for genus.

Wings hyaline ; pterostigma pale brown between black nervures, unbraced, over four cells ; three rows of postanal cells in forewing ; nodal index $\frac{9\text{–}12 \mid 12\text{–}8}{9\text{–}10 \mid 9\text{–}8}$.

Abdomen black marked with bright greenish yellow as follows :—Segment 1 with an apical spot on middorsum, narrowly confluent with a broad lateral fascia along the apical border of segment, segment 2 with a middorsal bilobed spot not quite reaching the apical border, the sides broadly yellow including the large oreillets, the subdorsal black curving down behind the oreillets, segment 3 similarly marked, but the lateral yellow usually finely divided by the black transverse suture, 4 and 5 with broad basal rings occupying about one-third the length of segments, a longitudinal oval spot on the middorsal carina at the middle of each segment, segment 6 similar but the dorsal spot absent, the basal ring on the sides overlapping the transverse suture for a short distance, segment 7 with its basal half or more yellow, this colour extending nearer the apical border on the sides than on the dorsum, segment 8 very similar to 7 allowing for the difference in length and breadth of the segments, segment 9 with only a small ventro-lateral medial spot, 10 unmarked.

Anal appendages as for genus, superiors yellow tipped on the outer side and bordered beneath with black, conical, tapering to a fine point, rather longer than segment 10, furnished with fine finger-like branches on the inner side, which spring from a point slightly basal to middle of appendage and converge inwards until their apices meet slightly before the level of the apex of superior appendages. Inferior black shorter than superiors, subtriangular, the apex markedly bifid, the two branches turning rather abruptly outward. (Fig. 3. 2.)

In many specimens the superior appendages have a minute but distinct spine present on the outer side near the apex, but it does not appear to be at all constant.

Genitalia : lamina black depressed deeply notched in a rounded arch ; inner hamules slim, spine-like, shorter than outer which are robust, parallel-sided, with the outer corner acutely spined and project back and down from the genital sac, yellow at base, black at apex ; lobe of penis bulbous black, deeply notched, very prominent.

Female. Abdomen 27 mm. Hindwing 23 mm.

Closely resembles the male, but more robust and larger. Occiput shallowly concave, with 4 to 5 minute black spines bordering it on either side of the middle line.

Lateral markings of abdomen more extensive, segments 4 to 6 with a long oval spot on the middle of each side. The middorsal oval spot on segment 5 absent ; segment 7 with the lateral yellow finely divided by the black transverse suture, 8 with the basal ring interrupted on the middorsal carina.

Anal appendages very small, yellow, conical, pointed.

Wings saffronated at the bases ; nodal index $\left.\frac{9-13}{8-10}\right|\frac{12-8}{9-9}$; two rows of cells between *Cuii* and the hinder margin of forewing.

Vulvar scale bright yellow, triangular, half the length of segment 9 bifid for half its length, the branches closely apposed.

Distribution. The western parts of the Deccan, Poona and Satara. The type, a female in the Selysian collection, probably comes from the former locality, where I have found it rather common during the wetter months of the year. Males may be seen resting on stones or rocks in the bed of the Byrobah Nullah and also in the neighbouring canal and Mullah River, or they may be beaten up from evergreens bordering these streams.

Microgomphus souteri Fras. (*Microgomphus torquatus souteri*) l.c. p. 474 (1924). (Pl. fig. 5.)

I had regarded this species as a subspecies of *torquatus*, but now, with more material available, see that the differences are so broad that the relationships must be much wider than I at first thought them to be.

Male. Abdomen 29 mm. Hindwing 24 mm.

Head. Labium pale yellow ; labrum glossy black with two large triangular greenish white spots nearly confluent at the middle of labrum and separated from the front border by a narrow stripe of black ; anteclypeus greenish white ; postclypeus and front of frons glossy black, the lower outer part of the former greenish white continuing the colour of the anteclypeus as a transverse stripe, which traverses the whole face at that level ; upper surface of frons greenish white, vertex and occiput black, latter slightly concave, fringed with yellow hairs but no minute spines visible ; eyes bottle green.

Prothorax black with a broad greenish yellow anterior collar.

Thorax black, markings differing from those of *torquatus* as follows :—The mesothoracic collar slightly interrupted in the middle, the middorsal carina unmarked with yellow bellow, no upper humeral spot, antehumeral stripes narrower and shorter, finally the black stripe on the postero-lateral suture is broader, and usually so broadly confluent with the shorter oblique stripe that the enclosed yellow ground colour is generally blotted out. Legs entirely black.

Wings not differing from those of *torquatus*, but reticulation closer and nodal index higher $\left.\frac{9-15}{12-11}\right|\frac{16-11}{11-11}$.

Abdomen black marked with greenish yellow as follows :—Segment 1 with a narrow apical border, 2 with a broad basal ring, which includes the oreillets and a short apico-lateral spot not always present, 3 to 6 with narrow basal rings occupying about one-sixth of the segments, 7 similar but the ring occupying the basal third and laterally overlapping the transverse suture, 8 to 10 unmarked.

Anal appendages as for genus but differing markedly from *torquatus* as follows :—The inner branches are much longer, in that they not only spring from the appendages much nearer the base, but extend also beyond their apices. The small outer spine near the apex of superior appendages is much more noticeable. Inferior appendage more robust, slightly longer than in *torquatus* (Fig. 3. 1.)

Genitalia similar to that of *torquatus* but the apex of outer hamules curling forwards.

Female. Abdomen 28 mm. Hindwing 25 mm.

Very similar to the male, its markings differing in the same respects as does the female from the male of *torquatus*, thus there are lateral oval spots on segments 4 to 6 but much smaller than in *torquatus*, and segments 8 to 10 are without markings. The basal marking on segment 7 is strictly limited behind by the transverse suture.

Distribution. Confined to Coorg and South Kanara. Types in the B. M., paratypes in Mr. C. A. Souter's and my own collections. Habits similar to the last. Breeds in the Sampaji and Hallery rivers, Coorg, and I have also taken it on the Kibribetta stream, 2,000 to 3,500 feet.

The differences between this species and *torquatus* are so numerous and marked that it is hardly necessary to point them out, but it will suffice to mention that in the former the face is largely black, whilst in *torquatus* it is largely yellow, in the former also the abdomen has the abdominal markings much more restricted, the upper humeral spot absent and lastly the inner branch of the superior appendage springs from nearer the base and extends beyond the appendage.

Microgomphus burmicus sp. nov. (Pl. fig. 6.)

Male. Abdomen 31 mm. Hindwing 28 mm.

Head : labium pale whitish green, the middle lobe with its base and free border blackish brown ; labrum black with two large rounded whitish green spots situated at the outer corners (a very unusual situation for this marking) ; bases of mandibles greenish white and a transverse stripe of the same colour at middle of anteclypeus ; rest of face and upper surface of head glossy black except for the crest of frons which is greenish white, finely divided at its centre by a narrow isthmus of black. Occiput concave at its centre with a slight angular projection at its outer ends.

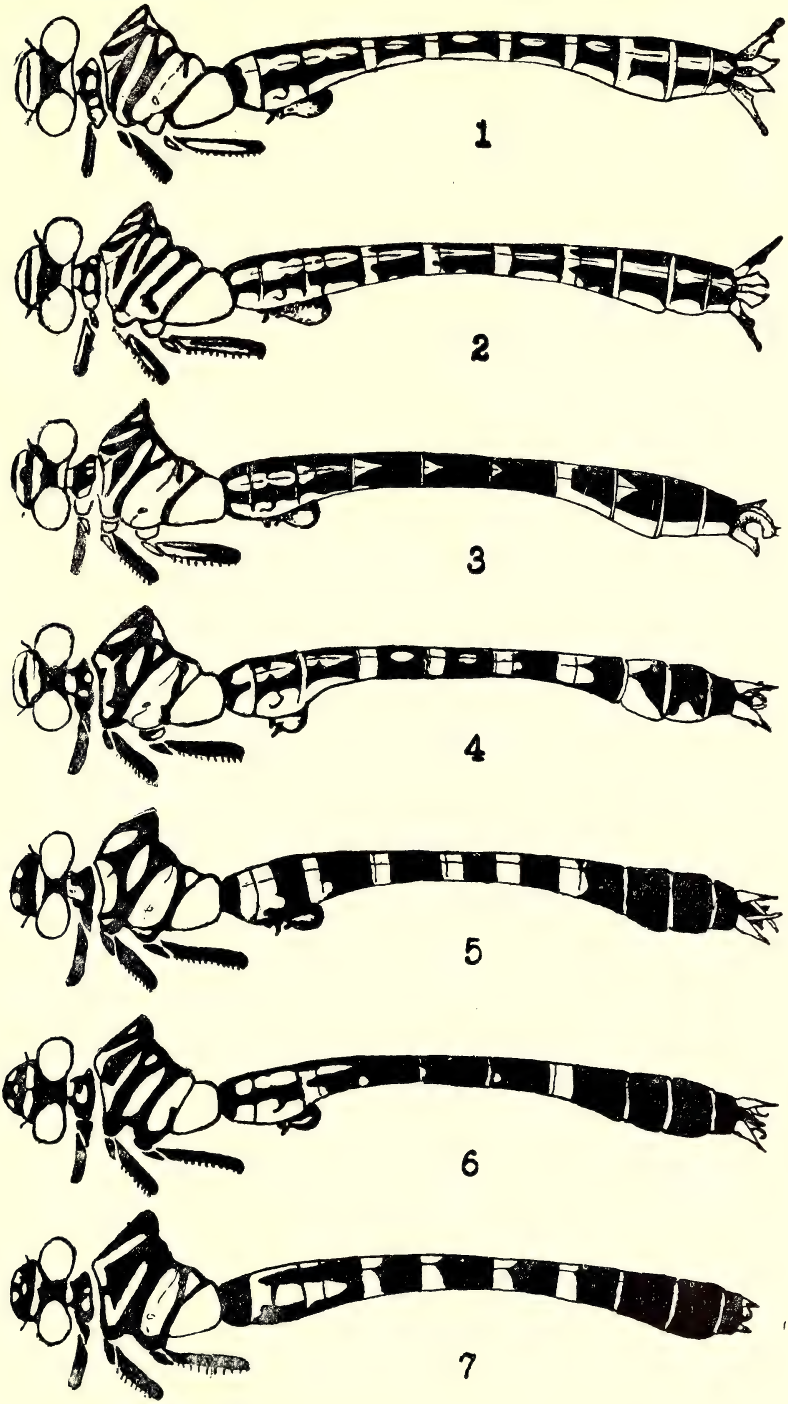
Prothorax black marked with greenish yellow as follows :—Very oblique broad antehumeral stripes which run from near the alar sinus and which are broadly confluent with an interrupted mesothoracic collar below, finally a small upper humeral spot ; the sides broadly greenish yellow marked with a broad black stripe on the first lateral suture and a short vestigial remnant of a similar stripe on the lower part of the second suture (another unusual type of marking).

Legs entirely black, armature as for genus and sex.

Wings hyaline, very palely enfumed ; pterostigma dark brown between black nervures, over four cells, short, unbraced, or the brace poorly developed and arising from the costa a short distance from the pterostigma ; nodal index $\frac{12-16 \mid 17-11}{12-12 \mid 12-11}$; three rows of postanal cells in hindwing, two rows of cells between *Cuii* and the hinder margin of forewing, other details as for genus.

Abdomen black, marked with greenish yellow as follows :—Segment 1 with the sides broadly and a medial stripe on the middorsal carina, which is flanked by a broad black stripe subdorsally, segment 2 similar, the lateral yellow including the oreillet, the dorsal yellow on the carina tapering apicad and expanded at the level of transverse suture ; 3 with the middorsal carina finely yellow and a large ventro-lateral basal spot on each side, 4 to 6 with small triangular basal spots on each side, 7 with a broad basal yellow ring occupying the basal fifth, remaining segments unmarked. Segment 9 shorter than 8, and 10 shorter than 9.

Anal appendages as for genus, superiors very robust, widely divaricate, tapering to a point, greenish white tipped with black. From the middle of the inner side, a slim pale yellow branch springs and inclines inwards to meet its fellow from the opposite side, the extreme apex of each branch strongly



Indian Dragonflies.

1. *Cyclogomphus ypsilon*, ♂
2. *C. wilkinsi*, ♂
3. *C. gynostylus*, ♂
4. *Microgomphus torquatus*, ♂
5. *Microgomphus souteri*, ♂
6. *M. burmicus*, ♂
7. *M. lilliputians*, ♀

recurved outwards. The fusion of these branches with the main appendage is demarcated by a fine groove, so that it is easy to understand that an increase in the size and robustness of the branch with a corresponding atrophy of the distal part of the appendage, would result in the evolution of the lyrate appendages of *Heliogomphus* (from which genus *Microgomphus* is hardly separable and not at all on venational grounds). Inferior appendage triangular, not bifid as long as superiors, black (Fig. 3. 3.).

Genitalia: hamules broad, short, tipped by a small spine; vesicle of penis bulbous, globular, black.

Female of the same size as male, very similar to the male in its markings, but these, on the abdomen, more extensive. On segments 3 to 6 a large triangular baso-lateral spot which extends to the transverse suture, beyond which, and only narrowly separated from the basal spot, is a narrow stripe extending almost to apex of segments. In one specimen there is also a minute basal lateral spot on segment 8.

Thorax and prothorax pruinosed white beneath, in adults.

Anal appendages short conical, pale greenish white.

Legs entirely black, armature as for genus and sex.

Wings palely enfumed in the adult, slightly saffronated at the base in tencrals; nodal index $\frac{13\text{–}15 \mid 16\text{–}12}{12\text{–}13 \mid 12\text{–}12}$, $\frac{11\text{–}16 \mid 15\text{–}10}{10\text{–}12 \mid 11\text{–}10}$, other details as for genus.

Distribution. One male and two females collected by Col. F. Wall, I.M.S., at Maymyo, Northern, Shan States, Upper Burma, 19–26. vi. 24 and 10. vii. 24. This species is remarkable for its large size (the largest known of the genus) and for the two unusual types of markings found on the labrum and sides of thorax. The two rows of cells between *Cuii* and the hinder margin of the forewing is clearly a response to the need of a greater wing area to support a weightier insect, and brings the venation of *Microgomphus* into line with that of *Heliogomphus*, insects of similar size to this particular species. The relationship of the superior appendages to this genus has already been commented upon above.

Microgomphus lilliputians, sp. nov. (Pl. Fig. 7.)

Female. (Male unknown.) Abdomen 20 mm. Hindwing 18 mm.

Head: labium pale yellow spots; bases of mandibles yellow, ante and post-clypeus black, the former with a central oval spot, the latter with a yellow spot on each side against the eyes: frons with the crest traversed with yellow, rest of head including the occiput black, latter simple, sinuous, a little notched at its middle.

Prothorax with a small spot on the posterior lobe and a larger at the sides, otherwise black.

Thorax black marked with bright yellow as follows:—An interrupted mesothoracic collar, oblique antehumeral stripes which are broadly confluent with the mesothoracic collar and form with it inverted '7' s; laterally greenish yellow marked on the postero-lateral suture by a thick black stripe, which by joining an oblique black shorter stripe, running from beneath the forewing, forms a black 'Y.'

Legs entirely black, spines on hind femora rather widely-spaced and more robust than usual in the genus.

Wings hyaline, saffronated at the bases, this probably an expression of their tenerality, reticulation rather close for so small an insect, trigones and subtrigones all angulated where joined by secondary nervures, sectors of arc apposed for a long distance, especially in the hindwings, discordal field in the forewings beginning with a single row of cells and continued as such for a distance of 3 rows, *Cuii* in forewings with only a single row of cells between it and hinder border (and only 6 cells in length), only 2 rows of cells in postanal area of hindwing; pterostigma brown, unbraced in two of the wings, poorly so in the others, over 3 cells; nodal index $\frac{7\text{–}12 \mid 11\text{–}7}{8\text{–}8 \mid 9\text{–}7}$.

Abodmen black marked with yellow as follows:—Segment 1 wholly black, 2 with broad subdorsal longitudinal stripes confluent over the base of segment and finely divided transversely by the transverse suture, 3 with a continuation of these stripes which do not however extend as far as the apical border, 4 to 7 with broad basal rings extending as far as the transverse sutures, remaining segments unmarked.

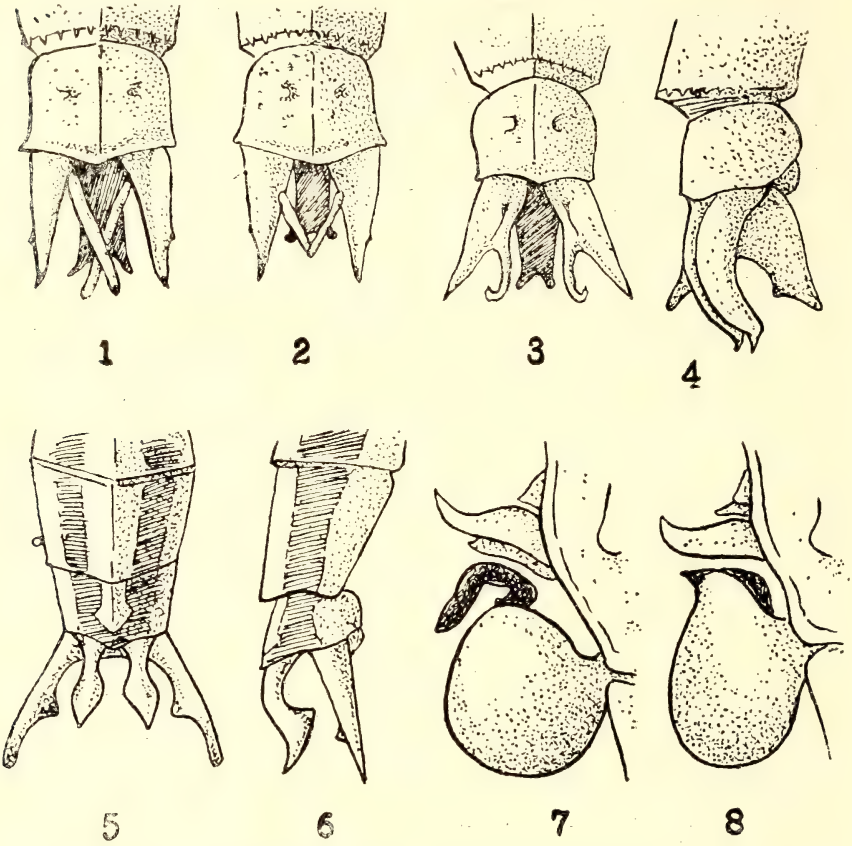


Fig. 3. 1. Anal appendages of *Microgomphus souteri* Fras, seen from above. 2. The same of *M. torquatus* (Selys). 3. The same of *M. burmicus* sq. nov. 4. Dorso-lateral view of anal appendages of *Cyclogomphus gynostylus*, male, sq. nov. 5. Anal appendages of *C. wilkinsi* sq. nov. seen from above. 6. The same seen from the side in profile. 7. Genitalia of *Cyclogomphus wilkinsi*, lateral view. 8. The same of *C. ypsilon* Selys.

Anal appendages small conical, yellow tipped with black.

Vulvar scale rudimentary.

Distribution. A single female from Tenasserim, Lower Burma, 18. iv. 23.

This species, which is the smallest known Gomphine, closely resembles *Tetrathemis platyptera* in size and general appearance, and in several respects, in its neuration also, thus the discoidal field beginning with a single row of cells. The only species likely to be confounded with it, is *Microgomphus chelifer* from the Malay Peninsula, which is somewhat larger, has a higher nodal index, the lateral thoracic stripe simple and not 'Y' shaped. The two are closely related and may even be conspecific. *M. lilliputians* is the only species in which the discoidal field of forewing begins with a single cell and it is the only female which has only one row of cells between the hinder margin of forewing and *Cuii* (in so far as I have examined). Just as we notice an increase in this latter area in the male of the former species *M. burmicus* to accommodate its greater weight, so here we see a corresponding decrease in response to the lessening need for a large wing area.

Microgomphus verticalis (Selys) (*Cyclogomphus verticalis*) Bull. Acad. Belg. (2) xxxvi, p. 501 (1873) ; Kirby, Cat. Odon. pp. 296–297 (1907).

Female. (Male unknown) Abdomen 27 mm. Hindwing 25 mm.

Similar to *M. torquatus*, differs only by the markings being less extensive, especially of the face, which is largely black.

Labrum with the yellow entirely enclosed as two large spots ; ante and postclypeus black with a medial spot of yellow and another on each side against the eyes. Frons similar but the vertex marked by a small yellow spot between the eyes.

The short description given by Selys, meagre as it is, clearly shows this species, which he classed as a *Cyclogomphus*, is really a *Microgomphus*, and that it is closely related to, if not conspecific with *torquatus*. The whereabouts of the type is unknown, but it was said to be in the Moore collection, and is given as from ' India '.

(*To be continued*)

NOTE ON A NEST OF THE COMMON INDIAN HORNET *VESPA CINCTA* FABR.

BY

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[*Read at the twelfth meeting of the Indian Science Congress held at Benares, and published with permission of the Director, Zoological Survey of India.*]

(*With a plate.*)

The nest with which the present note deals was recently acquired by the Zoological Survey of India, and is now being exhibited in the public insect gallery of the Indian Museum. It is believed to be one of the largest, if not the largest, specimen of its kind so far recorded.

The nest was found attached to the stem of a small Bael tree (*Aegle marmelos*) in a garden in South Intally, Calcutta. It was fixed at a height of about 4 feet from the ground, and was full of hornets of the species *Vespa cincta* at the time. So far as can be ascertained the hornets started building this nest in spring last year (1924). It was first noticed in March, and being no larger than a *bael* fruit was mistaken for it; in May it was the size of a man's head, and towards the end of October had attained its maximum size—over 3½ feet from top to bottom.

The nest was principally attached to the tree-trunk on one side near its (nest's) base, but it was also fixed to a fairly stout branch at its apex. Besides this several small branches passed right through the nest and gave it a fair amount of additional support.

The nest, as seen in the accompanying illustration (fig. 1) is perfectly pear-shaped. It is about 109 cm. long from apex to bottom, and over 64 cm. at its greatest breadth near the base. The outer envelope with its striking pattern of incomplete concentric circles completely encloses the nest, except at two nearly circular openings on the two sides near the base. Both of these serve for ingress and egress of the hornets, and the smaller of the two is seen in the reproduction.

The envelope, as is usual in the family *Vespidae*, is made of some papery material, which is believed to be a mixture of chewed wood and some glandular secretion. In nests of most hornets the envelope is made of some extremely soft and delicate material, but in the present case it was hard enough to stand a fair amount of rough weather. The present nest no doubt stood successfully the full force of the Calcutta monsoon for a whole season, and was in a perfect weather-proof condition at the time of its discovery.

On breaking open the envelope (fig. 2) on one side we see tiers of combs lying horizontally one above the other, and

NEST OF THE COMMON INDIAN HORNET *Vespa cincta* Fabr.

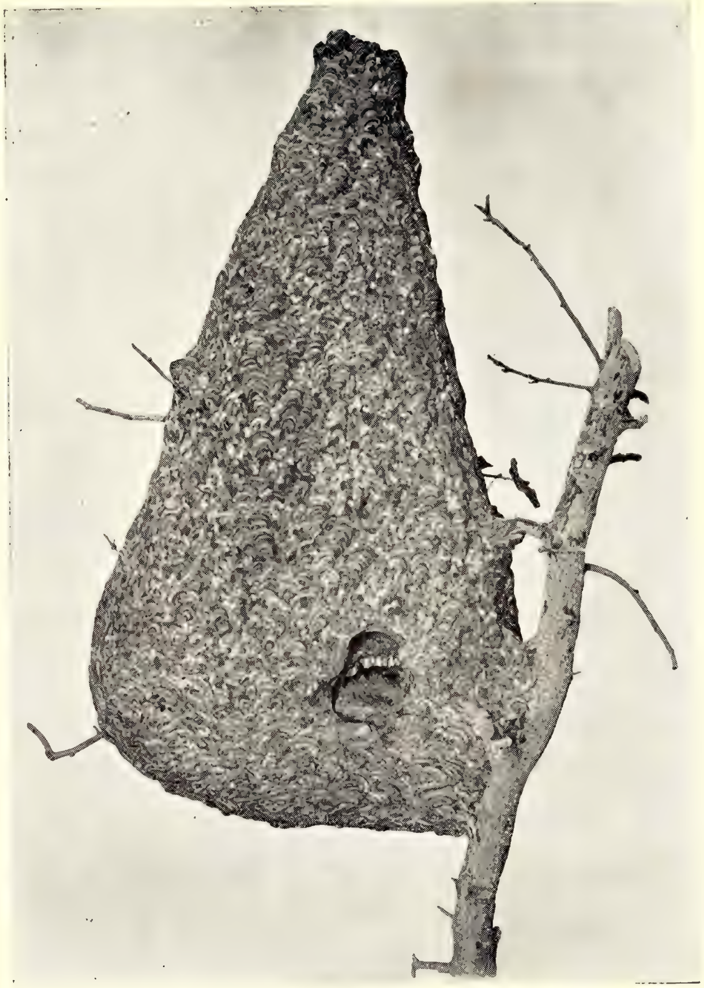

Fig. 1.

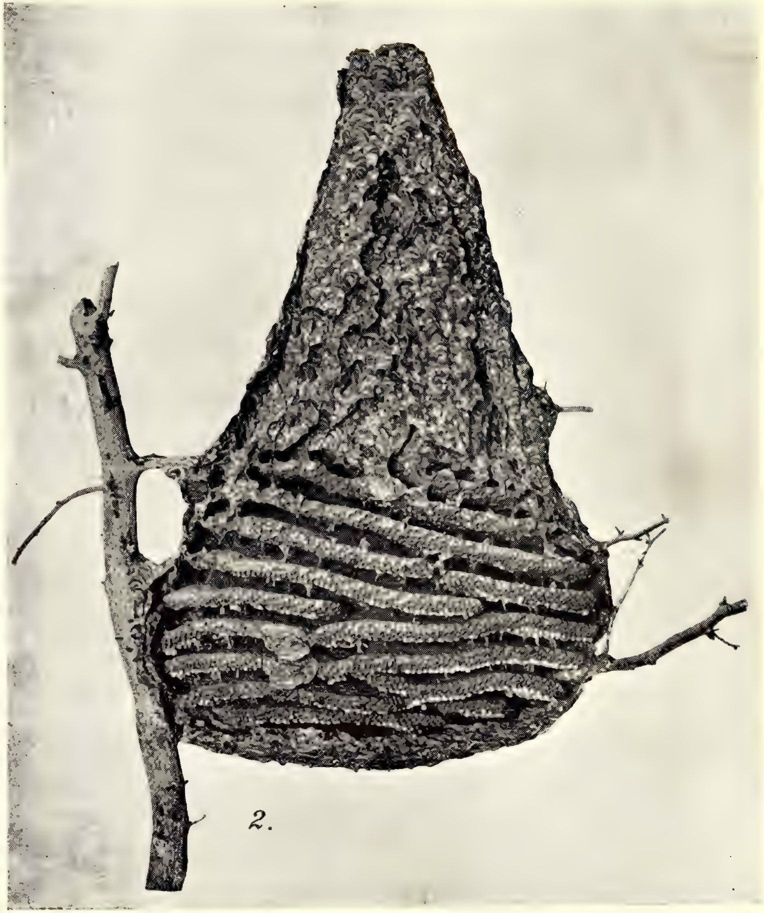

Fig. 2.

(*For explanation see end of article.*)

supported by short vertical pillars formed in between respective tiers. The combs consist of a very large number of cells and are the habitations of thousands of adults and young members of this vast colony. The lower three or four tiers of combs are seen to be full of larvae and pupae, while the upper ones which appear deserted, are evidently used by the adults. The cells housing the pupae are covered at their mouths with silken caps. The combs are not attached to the envelope, but there is a large amount of space left between the two, so that access is available to each comb all round. The envelope, especially in its upper parts, is several layers thick, and in its structure contains a net-work of air-pockets which give the appearance of tunnel-like passages connecting the upper tiers with the general space round the basal combs. I am unable to say whether these passages are used by the hornets or not, but as, on killing the colony with potassium cyanide, several of them were found lying dead in these passages, it is quite possible that they form at least a secondary means of communication.

Vespa cincta is a common species in the plains of India, but is not quite so common as the smaller *V. orientalis*. The latter is known to build very large nests, but, so far as I am aware, no large nest of the former has so far been recorded. *V. cincta* generally lives in thick forests, and is said to build its nests in the holes of large fig and other forest trees.

De Saussure,[1] the monographer of social wasps, has classified them according to the architecture of their nests. The classification is far from satisfactory, but is still the only standard work of its kind. I do not propose going here into the details of this classification, but according to de Saussure *V. cincta* would come in his principal class *Stelocyttares*, sub-class *Calyptodomes*. These wasps have nests which are characterized, among other things, by the possession of an envelope, which is not attached to the combs, and by the combs being supported on one another by vertical pillars. The sub-class *Calyptodomes* has two types depending upon the nature of the envelope. In the first the envelope is 'foliacée, composée de feuillets concentriques' while in the second the envelope is 'celluleuse'[2] *V. cincta* with its nest having an envelope formed of several leaf-like layers would seem to belong to the first category. There is still another division based upon the mode of attachment of the nest. When the nest is supported by a central pedicle the term 'rectinides' is applied, but if the support is lateral the nest is 'letérinide.' There are still further sub-divisions, but it would be useless to discuss them here.

Savin[3] has quite recently written an interesting note on the nests and habits of some American social wasps. The paper, though it contains some good photographs of Vespid nests, deals chiefly with the common yellow wasp *Polistes*.

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[1] De Saussure, *Monographie des Gupês Sociales*, pp. cc. and 256, pls. i-xxxvii, Paris and Geneva (1853-1858).

[2] De Saussure, *op. cit.*, p. lvii.

[3] Savin, *Nat. Hist.*, xxv, pp. 81-86 (1925).

In the end I would like to express my appreciation of the way in which Mr. R. Hodgart, the energetic collector of the Zoological Survey, in spite of the risk involved in it, managed to bring this very interesting nest to the Museum intact.

Explanation of Plate

Both the figures are from direct untouched photographs of the nests.

1. Complete nest, showing the smaller opening for the entrance and exit of the hornets.

2. The same, with a part of the envelope removed on one side to show the air pockets in the upper portion and the tiers of combs in the lower. The vertical pillars between the various tiers are also visible.

AN ANNOTATED LIST OF THE THYSANOPTERA KNOWN FROM INDIA AND CEYLON

BY

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In 1919 the writer published a small note [1] on Indian Thysanoptera, and it may be gathered from it that prior to 1912 hardly anything of importance was known or on record regarding the Indian representatives of the group Thysanoptera, in spite of the fact that the group is one of the major divisions into which insects are divided and that members of this group are very commonly met with all over India ; and naturally therefore, practically no attention appears to have been devoted to the scientific or economic importance of these insects in India. In fact the Indo-Ceylonese region practically remained a *terra incognita* to Thysanopterists till the year 1912. Prior to this period we have only two records, one of two Indian forms described by Newman [2] in 1856, viz. *Idolothrips halidayi* and *Phlœothrips anacardii* collected on a species of *Anacardium* in Mysore, and another in 1909 by Kieffer (' *Cecidothrips* ' from Trichinopoly, S. India) in ' Marcellia ' VII. In his monograph of the order mostly including European forms, Uzel [3] has just copied the two descriptions of Newman without any further record from India, but adding one species from Ceylon *Phlœothrips stenomelas*, Wlk., the description of which is also copied from that of Walker (A. M. N. H. 1859). In 1912 Mr. Bagnall the eminent English Thysanopterist described [4] an interesting species of thrips *Panchœtothrips indicus* from material collected and sent to the Indian Museum by the Madras Revenue Board in 1889. From the year 1913 onwards our knowledge of Indo-Ceylonese forms gradually began to increase as may be found from the series of systematic papers [5] on the group published by Bagnall since then. However, all forms recorded by him up to 1919, are only North Indian and Ceylonese ones, and none from South India. With regard to South India a regular collection and a study of the bionomics of South Indian Thysanoptera might be said to have commenced in 1915 when the material of ' Paddy thrips ' collected by the writer and forwarded to the Imperial Bureau of Entomology, London, was described by Mr. C. B. Williams [6] as a new species *Thrips* (Bagnallia) *oryzae*. Since then all records from South India refer to material brought together by the writer and mostly collected by himself. In 1916 a small lot of South Indian forms was forwarded to Mr. J. D. Hood, the well-known American expert on the order, and he published in 1919 a paper [7] based on that material, and this may be regarded as the first connected paper on South Indian Thysanoptera. Meanwhile, Mr. Bagnall also kindly undertook to help, and material was submitted to him in 1919. Though he has not been able to work out the whole lot sent to him, he has been publishing descriptions of some new forms from the material, on and off since 1919. As to Ceylonese forms of the order, a fairly good number have been described by Bagnall in his serial papers in the Annals. The only connected paper on ceylonese forms, however, is that of Karl Schmutz[1] in 1913; the descriptions and synonymy in this paper have, however, been somewhat severely criticized by other workers, chief among them being Dr. Karny, the famous Austrian specialist on the group.

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[1] On our present knowledge of ' the Indian Thysanoptera and their economic importance.' pp. 618–22. Report of the 3rd Entomological Meeting at Pusa in 1919–20.

[2] Transactions of the Entomological Society, London, 1856.

[3] Monographie der Ordnung Thysanoptera by Heinrich Uzel, Koniggratz, 1895.

[4] Records of the Indian Museum, p. 257, Vol. VII, 1912.

[5] Bagnall's serial papers on the group began with paper No. 1 in 1913 and No. XIV appeared in December 1924 ; all in the Annals and Magazine of Natural History, London.

[6] p. 353, Bulletin of Entomological Research, Vol. VI, London, 1915.

[7] ' On some new Thysanoptera from South India by J. D. Hood, pp. 90 103. Insecutor Insectiæ Menstruus,' xii, 1919, Washington.

In this paper an attempt is made to catalogue the known Thysanoptera of India and Ceylon as a working reference list, and as a sort of preliminary preparation for detailed papers, whenever possible in future, on the systematics and bionomics of the Thysanoptera inhabiting the Indo-Ceylonese region.

All records as far as possible up to 1924 have been included here and it is believed the list is more or less up to date. The records include species so far known from the region divided among 47 genera. Of these about half a dozen are recently erected genera and all species except about half a dozen are new to science. Compared to the 3 or 4 forms alone that were known from the region in 1912, this addition must be admitted to be substantial. There is hardly any doubt that a good many new forms will be described from the author's unworked material[2] (a good portion of which is now with Dr. Karny in Java), while numerous unexplored tracts of the country are sure to contain novelties awaiting the discovery of enthusiastic workers.

Now that the importance of this order of insects, both from the scientific and economic aspects, is beginning to be realized, it is hoped, that these insects might receive the attention they really deserve, and it is believed that this list, with all its inevitable shortcomings, may serve some useful purpose, at least to those who might contemplate working at this group. The author is greatly indebted to Messrs. Hood, Bagnall, and Dr. Karny for the help received from them, and particularly to Dr. Karny for the valuable suggestions and encouragement ever since the author had the honour of his acquaintance.

The arrangement followed in the list is more or less based on the synoptical tables of Dr. Karny. It may not be out of place here to append Dr. Karny's[3] synopsis of the major sub-divisions of the order, since that appears to be the most recent and perhaps, up-to-date classification. Though the greater portion of Karny's arrangement is that of Hood,[4] the former has made some deviations. The translation[5] of the German synopsis was made by the author himself with the help of Hood's tables, but it is not unlikely there may be some errors.

Key to the sub-divisions and families of

THYSANOPTERA

I. Female with an ovipositor formed of two pairs of gonapophyses from 8th and 9th abdominal segments. Terminal abdominal segment seldom tubular, that of female longitudinally divided beneath and usually conical, that of male usually bluntly rounded, never tubular. Wings microscopically pubescent; forewing with marginal vein and at least one longitudinal vein reaching tip.

Sub-order.........TEREBRANTIA

A. Ovipositor curved upward. Wings broad and rounded at tip. Body not depressed. Antennæ nine jointed.

Super family.........AEOLOTHRIPOIDEA, Hood.

Includes only one family—AEOLOTHRIPIDŒ, Uzel.

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[1] K. Schmutz-Zur Kenntnis der Thysanopterenfauna von Ceylon, pp. 991–1091 with 6 plates in Sitzber. Akad. Wiss. Math. Nat., Kl., Vienna, 1913.

[2] Dr. Karny has now prepared a monograph on this material submitted to him and it is being published. The paper includes 50 records, with four new genera, and eighteen new species.

[3] Thysanopetera—Uebersichtstabelle. Karny, pp. 231–61. 'Treubia, vol. I, livr. 4, 1921.

[4] An outline of the sub-families and higher groups of the order Thysanoptera by J. D. Hood, pp. 53-60, Proc. Biol. Socy., Washington, XXVIII, 1915.

[5] Since submitting this paper to the press, the author has seen a translation of Dr. Karny's full synopsis in the Bulletin (No. 168 of the Florida University, Published December 1923) on N. American Thysanoptera by J. R. Watson.

B. Ovipositor curved downward. Wings narrower and almost always pointed at tip. Body more or less depressed. Antennæ six to eight jointed (exceptionally nine jointed).

Super family.........THRIPOIDEA, Hood.

(*a*) Antennæ nine segmented, without apical stylus, 3rd and 4th segments enlarged and conical without sense cones but with sensory band at apex. Fore tarsus with claw like appendage.

Family.........HETEROTHRIPIDÆ, Bagnall.

(*a*¹) Antennæ six to eight segmented, usually with an apical stylus of one or two segments, rarely the 6th segment with a transverse line making the antenna appear nine segmented. Segments 3 and 4 not conical, usually with sense cones, rarely with a sensory band at apex. Fore tarsus never with an appendage.

(*b*) Antennæ not moniliform, six to eight segmented always with a one or two jointed apical stylus, 3rd segment usually 4th always with sense cones, never with a tympanum like sense area on dorsum of apex. Pronotum without longitudinal dorsal sutures, anterior and posterior femora not enlarged. Tip of abdomen usually sharply conical. Ovipositor almost invariably well developed.

(*c*) Sixth antennal segment large, never small in comparison with fifth, generally the largest in the whole antenna.

(*d*) Last abdominal segment of female conical, not well chitinized, seldom stronger than the preceding segments, bristles on segments 9 and 10 not very long or stout, never thornlike.

Family.........THRIPIDÆ, Uzel.

(*d*¹) Last abdominal segment of female cylindrical, very heavily chitinized bristles on 9 and 10 segments exceptionally long, stout and thornlike.

Family.........PANCHAETOTHRIPIDÆ, Bagnall.

(*c*¹) Sixth or sixth and seventh antennal joints small, styliform, minute in comparison with the fifth which is the largest in the whole antenna.

Family.........CERATOTHRIPIDÆ, Bagnall.

(*b*¹) Antennæ moniliform eight segmented, without apical stylus, third and fourth segments without sense cones, each with a tympanum like sense area on dorsum of apex. Pronotum with longitudinal dorsal sutures, anterior and posterior femora greatly enlarged. Abdomen blunt, ovipositor very weak, probably functionless.

Family.........MEROTHRIPIDÆ, Hood.

II. Female without ovipositor. Last abdominal segment in both sexes always continuous beneath, almost invariably tubular. Wings without pubescence forewing with at most a single abbreviated median vein.

Sub-order.........TUBULIFERA

A. Maxillary palpi 2 segmented. Antennæ eight, rarely seven segmented, middle coxæ more apart from each other than front and hind coxæ. Ninth abdominal segment not or rarely longer than the eighth. Terminal abdominal hairs rarely much longer than tube.

Super family.........PHLŒOTHRIPOIDEA, Hood.

(*a*) Last abdominal segment absolutely not tubular, greatly swollen, parabolic in dorsal aspect. Tergum of abdominal segments 2 to 9 transversely linear.

Family.........PYGOTHRIPIDÆ, Hood.

(*a*¹) Last abdominal segment slender, cylindrical or tubular, forming the tube. Tergum of abdominal segments 2 to 9 not transversely linear.

(*b*) Hind end of 8th abdominal segment without hook or cone-shaped projections.

(*c*) Tube (last segment) much shorter than the remaining segments together.

(*d*) The third segment of antenna with strong crest-like large sense cones at its distal part.
Family.........Ecacanthothripidæ,[1] Bagnall.

(*d*[1]) Sense cone of third antennal segment not more strongly developed than in the other segments.

(*e*) Sense cone of antenna usually long and pointed ; near each there is an accessory cone or a long slender bristle in addition ; on this account the antennal segments are markedly swollen. The eyes are unusually large, close together, mouth cone pointed.
Family.........Eupathithripidae,[1] Bagnall.

(*e*[1]) Sense cone of feeler not specially well developed, eyes smaller.

(*f*) Male without a tube like projection on each side of sixth abdominal segment.

(*g*) Head not produced in front of the eyes, vertext not sharply conical, rarely prominently overhanging base of antennæ.
Family.........Phloeothripidae, Uzel.

(*g*[1]) Head more or less produced in front beyond the eyes, vertex conical, usually over hanging base of antenna, bearing the anterior ocellus at its extremity and usually with a strong bristle in front of the eye.
Family.........Idolothripidæ, Bagnall.

(*f*[1]) Male with stout tube like projection on each side of the sixth abdominal segment.
Family.........Megathripidæ, Karny.

(*c*[1]) The tube greatly elongate, three or four times as long as the head, and nearly as long as all other abdominal segments together.
Family.........Hystricothripidæ, Karny.

(*b*[1]) Hind end of 8th abdominal segment with a hook or cone-shaped process, the antennæ and tube short and thick.
Family.........Chirothripoidiidæ, Bagnall.

B. Maxillary palpi one jointed. Antenna four to seven segmented. Hind coxæ more widely separated than the front and middle pairs. Ninth abdominal segment longer than the eighth. Terminal bristles of abdomen much longer than the tube.

Super family.........Urothripoidæ, Bagnall.

Only one family.........Urothripidæ Bagnall.

Dr. Karny's synopsis of Keys to the known genera is not added here as it is pretty long. The Keys in the same publication (Treubia Vol. I) and the same author's numerous Keys for distinguishing the described *spp.* of various genera found in the pages of Zt. fur. Wissen Insektenbiol, 1914–16, will be very useful to workers on this group.

LIST[2] OF INDO-CEYLONESE THYSANOPTERA

Sub-order—TEREBRANTIA

Aeolothripidæ

Aeolothrips, Haliday

A. fulvicollis, Bagnall, p. 253. A. M. N. H., iv, 1919. In *Verbascum* flowers, very close to *A. fasciatus*, L. (Imms. Coll.), Cawnpore.

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[1] Hood considers that these two families erected by Bagnall are synonyms of Phlœothripidœ Uzel, and gives reasons, *vide* pp. 7–12. Psyche, xxiii, 1916.

[2] Only the more important references are given under each species ; the same is the case with regard to synonyms, localities and host plants.

THRIPIDÆ

Scirtothrips, Shull

S. signipennis, Bagnall, p. 22, A.M.N.H., xiii, 1914. Under leaf sheaths of banana..................Peradeniya, Ceylon.

S. dorsalis, Hood, p. 90. Ins. Incis. Menstr. April 1919. In shoots of castor and chillies..................Coimbatore. (Ramakrishna Coll.)

Pseudodendrothrips, Schmutz

P. ornatissima, Schmutz, p. 999, Sitzber. Akad. Wiss., cxxii, 1913. On *Macrocarpus integrifolia*..................Peradeniya. Ceylon.

Dendrothrips, Uzel

D. sexmaculatas, Bagnall, p. 401, A. M. N. H., xvii, 1916. Peradeniya. Ceylon.

D. indicus, Bagnall, p. 261, A. M. N. H., iv, 1919. In arrow-root leaves Taliparamba, S. India. (Ramakrishna Coll.)

Very near *sexmaculatus*, B. differing in colour of abdomen and wings.

D. bispinosus, Bagnall, p. 455, Bul. Ent. Res., xiv, 1924. On tea leaves ....Nilgiris. (Near *D. saltatrix*, Uzel.)

Rhipiphorothrips, Morgan

R. (*Retithrips*) *bicolor*, Bagnall, p. 290, A. M. N. H., xii, 1913. On vine ....Ceylon.

R. cruentatus, Hood, p. 94, Ins. Insc. Menst., April 1919. On grape vine leaves......................Coimbatore. (Ramakrishna Coll.)

On *Careya arborea*......................Ceylon. (Rutherford Coll.)

Selenothrips, Karny

S. (*Physopus*) *rubrocinctus*, Giard. Bull. Soc. Ent. France, p. 263, 1901, and also Trop. Agri., xxvii, 1906. Cacao thrips. (W. Indies). Noted also in mango in Florida.

=*S. mendax*, Schmutz, p. 994, Sitzber. Akad. Wiss., cxxii, 1913. On *Anacardium orientale*..........................Peradeniya. Ceylon.

Heliothrips, Haliday

H. indicus, Bagnall, p. 291, A.M.N.H., xii, 1913. On onion, brinjal, and on indigo....................Sirsiah (Behar) and Surat (Bombay).

H. brunneipennis, Bagnall, p. 318, A. M. N. H., xv, 1915. On *Litsea* leaves ....Peradeniya. Ceylon.

H. minutissimus, Bagnall, p. 260, A. M. N. H., iv, 1919 in Violet flowers ....Surat.

H. hæmorrhoidalis, Bouche *var Ceylonica*, Schmutz, p. 992, Sitzber. Akad. Wiss., cxxii, 1913, on cacao ;.........Peradeniya. Ceylon.

Frankliniella, Karny

F. sulphurea, Schmutz, p. 1019, Sitzber. Akad. Wiss., cxxii, 1913 ; in flowers of *Thunbergia alata*....................Peradeniya. Ceylon.

For other *spp.* see below under *Physothrips*.

Taeniothrips, Serville

T. major, Bagnall, p. 216, A. M. N. H., xvii, 1916, in *Rhododendron* flowers.........................Garhwal. N. India.

Physothrips, Karny

P. lefroyi, Bagnall, p. 292, A. M. N. H., xii, 1913 ; in Tea flowers............. Darjiling ; also p. 63, Bull. Ent. Res., ix, 1918.

P. usitatus, Bagnall, p. 293, A. M. N. H., xii, 1913 ; in flowers of *Butea frondosa*. Allahabad, N. India ; *Frankliniella nigricornis* and *F. obscuricornis* of Schmutz, pp. 1020 and 1022 Sitzber. Akad. Wiss., cxxii, 1913 on coffee and *crotalaria* from Ceylon are according to Karny same as *P. usitatus*, Bagnall, *vide* p. 365. Zt. Fur. Wissen. Insekt, x, 1914.

P. longiceps, Bagnall, p. 220, A. M. N. H., xvii, 1916 in *Rhododendron*, flowers....................Garhwal. N. India.

P. (*Frankliniella*) *vitata*, Schmutz, p. 1023, Sitzber. Akad. Wiss., cxxii, 1913 ; in *Thunbergia* flowers.........Peradeniya. Ceylon.

P. setiventris, Bagnall, p. 61, Bull. Ent. Res., ix, 1918. On Tea.............. Darjiling. N. E. India ; also p. 305, Treubia, iii 1923.

P. brunneicornis, Bagnall, p. 218, A M. N. H., xvii, 1916, first noted from Japan. p. 206, A. M. N. H., 1918, on Rose. Darjiling.

P. peculiaris, Bagnall, p. 206, A. M. N. H., i, 1918 on Lucerne. Pusa. N. India, also p. 305, Treubia, ii, 1923.

P. minor, Bagnall, p. 393, A. M. N. H., viii, 1921 ; in leaves of *Ipomea staphylina*..........Maddur, and Coimbatore, S. India (Ramakrishna Coll.)

P. andrewesi, Bagnall, p. 394, A. M. N. H., viii, 1921. Darjiling.

P. flavidulus, Bagnall, p. 628, A. M. N. H., xii, 1923 ; in flowers of *Eriobotyia japonica*. Dehra Dun ; also noted at Bhowali (Kumaon).

Thrips, *Linnaeus*

Thrips striatopennata, Schmutz, p. 1002, Sitzber. Akad. Wiss., cxxii, 1913. on grass ; Nuwara Eliya, Ceylon.

T. florum, Schmutz, p. 1003 do. do. do. In *Cinnamomum* flowers.................Peradeniya. Ceylon.

(*T. magnipes*, Schmutz, p. 1006 and *T. rhodamnine*, Schmutz, from Ceylon on *clerodendron* and *Rhodamnia*, p. 1008 do. do. are contracted specimens of *T. flora*, Schmutz according to Karny, *vide* p. 109, Jour. Siam. Socy., xvi, 1923.)

T parva, Schmutz, p. 1004, Sitzber. Akad. Wiss., cxxii, 1913 in *Cinnamomum* flowers....................Ceylon.

T. longalata, Schmutz, p. 1009 do. do. do. on *Cinnamomum* and *Clerodendron* leaves.................Peradeniya. Ceylon.

T. sulphurea, Schmutz, p. 1011 do. do. In *Cinnamomum* flowers. ....Peradeniya. Ceylon.

T. nigriflava, Schmutz, p. 1012 do. do. do.

T. colorata, Schmutz, p. 1013 do. do. do.

(This is regarded by Karny as a colour *var* of *T. florum*.)

T. pallida, Schmutz, p. 1015, Sitzber. Akad. Wiss., cxxii, 1913....... ....Peradeniya. Ceylon (Some of the above *spp.* of Schmutz are regarded as synonyms of *florum*, Sch. by Karny.)

T. (*Bagnallia*) *oryzae*, Williams, p. 353, Bull. Ent. Res., 1915, on young paddy, Chingleput. S. India (Ramakrishna coll.) ; see also p. 109, Jour. Siam. Socy., xvi, 1922, noted in Java (Karny).

T. pallidulus, Bagnall, p. 424, A. M. N. H., xiii, 1924.....................Pusa.

Rhamphothrips, Karny.

R. lineata, Schmutz, p. 997, Sitzber. Akad. Wiss., cxxii, 1913. Peradeniya, Ceylon. This is described by Schmutz as *Brachythrips*. See p. 295, Zt. f. Insekt, 1914, for Karny's note.

Dendrothripoides, Bagnall.

D. ipomeæ, Bagnall, p. 625, A. M. N. H., xii, 1923, in leaves of *Ipomea staphylina*.......................Maddur, Mysore (Ramakrishna coll.)

Euthrips Targ-Tozz.

(Hood objects to the use of the name Euthrips [1]).

E. citricinctus, Bagnall, p. 270, A. M. N. H., iv, 1919. On Arrow-root leaves.......................Taliparamba. South India. (Ramakrishna coll.) ; very close to Karny's *E. flavicinctus* from Java.

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[1] On proper generic names for certain Thysanoptera of economic importance Hood, pp. 34-44, Proc. Ent. Socy., Washington, xiv, 1914.

E. flavicinctus, Karny, p. 115, Marcellia, xi, 1912, in galls of *Homalomena aromatica* in Java. See also p. 55, Bull der. Tard. Bot. Buitenzorg, x, 1913.
=Neophysopus medioflavus, Schmutz, p. 1017, Sitzber. Akad. Wiss., cxxii, 1913. *vide* Karny, p. 357, Zt. Fur. Wissen Insekt, 1915. Peradeniya. Ceylon.

Aptinothrips, Haliday.

A. rufus var. connaticornis, Uzel-Bagnall, p. 205, A. M. N. H., i, 1918, in Tea flowers..Darjiling.

Perissothrips, Hood

P. parviceps, Hood, p. 92, Ins. Insc. Mens., vii, 1919, in shoots of *Ailanthus excelsa*. Coimbatore (Ramakrishna coll.) near *Chilothrips* and *oxythrips*.

Bregmatothrips, Hood.

B. Ramakrishnæ, Bagnall, p. 625, A. M. N. H., xii, 1923, inside tips of rolled up sugar-cane leaves. Palur. South India (Ramakrishna coll.)

Tryphactothrips, Bagnall.

Dinurothrips rutherfordi, Bagnall, p. 319, A. M. N. H., xv, 1915.
=*Tryphactothrips* do. Bagnall, p. 257. do. iv, 1919.
On *allamanda* leaves. See also p. 264. do. do. 1921. Ceylon.
This is the type of Bagnall's genus.
T. octarticulata, Schmutz, p. 993, Sitzber. Akad. Wiss., cxxii, 1913. Peradeniya. Ceylon. This species is described by Schmutz as a *Parathenothrips*, Uz.

Bagnall is of opinion that ' Dinurothrips ' should be placed near *Heliothrips* and not with *Panchætothrips*.

PANCHÆTOTHRIPIDÆ

Panchætothrips, Bagnall

P. indicus, Bagnall, p. 257, Rec. Ind. Mus., 1912, on *Curcuma longa*......... Madras, also on Arrow-root leaves, Taliparamba. S. India. (Ramakrishna coll.)

Sub-order—TUBULIFERA

ECACANTHOTHRIPIDÆ

Ecacanthrothrips, Bagnall.

E. sanguineus, Bagnall, p. 321, A. M. N. H., xv, 1915, and also p. 201. Rec. Ind. Mus., 1913.
= *Acanthothrips sanguineus*, Bagnall (1908)
= *ormothrips sanguineus*, Buffa (1910)
= *Do. steinsky*, Schmutz. (1913)

(See p. 277, ' Treubia,' iii, 1923, for these synonyms.) Under tree bark; recorded from Peradeniya, Ceylon,—and North India.

PHLŒOTHRIPIDÆ

Phlœothrips, Haliday

P. anacardii, Newman, p. 266, Trans. Ento. Soc., 1855, on *Anacardium*. Mysore.
P. stenomelas, Walker, p. 224, A. M. N. H., 1859..................Ceylon.

Liothrips, Uzel

L. ordinarius, Hood, p. 101, Insc. Mens., vii, 1919, in shoots of *Sesbania grandiflora*............Coimbatore. (Ramakrishna coll.)
L. niger, Schmutz, p. 1080, Sitzber. Akad. Wiss., cxxii, 1913, Peradeniya. Ceylon; described as an *Ischyrothrips*. See also reference by Karny pp. 46 to 49, Treubia, ii, 1921.
L. sp. Kieffer, ' Marcellia,' 1905 in galls of *Quercus apicata*. North India.

Dolichothrips, Karny

D. varipes, Bagnall, p. 359, A. M. N. H., vii, 1921, on wild bush. Coimbatore. (Ramakrishna coll.)

Cephalothrips, Uzel

C. hispanicus, Bagnall, p. 629, A. M. N. H., 1923, in *Rhodhodendron* flowers. ....Garhwal, North India.
= *Malacothrips*, Bagnall. See p. 635, A. M. N. H. (9), xiv, 1924.

Hindsiana, Karny

H. apicalis, Bagnall, p. 323, A. M. N. H., xv, 1915, on jungle plant; ....Almora, North India.

Haplothrips, Serville

H. tenuipennis, Bagnall, p. 210, A. M. N. H., i, 1918, on Tea bushes and rose. ....Darjiling. (Andrews coll.)
H. pictipes, Bagnall, p. 273, A. M. N. H., iv, 1919, on diseased pepper berries..........................Taliparamba, South India. (Ramakrishna coll.)
H. terminalis, Schmutz, p. 1033. Sitzber. Akad. Wiss., cxxii, 1913, on bamboo..............................Ceylon. See also 'Treubia,' ii, p. 32, 1921. Karny thinks this is probably a *Mesothrips*.
H. ceylonica, Schmutz, p. 1038, Sitzber. Akad. Wiss., cxxii, 1913, in *Crotalaria* flowers..............................Peradeniya. Ceylon.
H. soror, Schmutz, p. 1039. do. do. do. Ceylon.
H. ganglbaueri, Schmutz, p. 1034. do. do. do. Peradeniya. Ceylon.
H. sororcula, Schmutz, p. 1036. do. do. do. in *Crotolaria* flowers. ....Peradeniya. Ceylon.

A long note by Karny on this genus and some Ceylon spp. of Schmutz is found on p. 87, Zt. fur. Wiss. Insekt, xi, 1915.

Neoheegeria, Schmutz

N. fumipennis, Bagnall, p. 360, A. M. N. H., vii, 1921. Kurseong. Himalayas. (Gravely coll.)
N. citripes, Bagnall, p. 360. do. do. an *Abutilon indicum*..............................Pusa.
N. indica, Hood, p. 96, Ins. Insc. Mens., vii, 1919, in *Ailanthus excelsa* shoots. Coimbatore. (Ramakrishna coll.)
N. zizyphi, Bagnall, p. 629, A. M. N. H., xii, 1923, on *Zizyphus rugosa*, Paresnath, Bengal.

Cecidothrips, Kieffer

C. bursarum, Kieffer, p. 165, 'Marcellia,' vii, 1909, from unknown plant galls. Trichinopoly, South India.

Cœnurothrips, Bagnall

C. affinis, Bagnall, p. 361, A. M. N. H., vii, 1921, among cotton. Ceylon.

Austrothrips, Brethes

A. cochinchinensis, Karny, p. 113, Jour. Siam. Socy., xvi, 1923. Very common in galls of *Calycopteris floribunda*. Western Ghats. (Y. R. Rao and Ramakrishna coll.)

Originally described by Karny from Siam collected in leaf galls of *Hymenodictyon parviflorum*. (See also p. 436, Agrl. Jour. India, July 24.)

Trichothrips, Uzel

T. (*Neosmerinthothrips*) *fructuum*, Schmutz, p. 1052, Sitzber. Akad. Wiss., cxxii, 1913..................................Peradeniya. Ceylon.

Eumorphothrips, Schmutz

E. albicornis Schmutz, p. 1050, Sitzber. Akad. Wiss., cxxii, 1913, in *Cinnamomum* flowers..................................Peradeniya. Ceylon.
(See pp. 145 and 147 of Zt. Fur. Wiss. Insekt, xi, 1915 for notes by Karny.)

Androthrips, Karny

A. flavipes, Schmutz, p. 1031, Sitzber. Akad. Wiss., cxxii, 1913, Ceylon.
A. flavipes, Bagnall, p. 27, A. M. N. H., xiii, 1914. Ceylon; On *Memexylon*.

Under the same name the above two spp. are described by different authors and it is not known whether the two are synonymous. See p. 94, Zt. Fur. Wiss. Insekt, xi, 1915, where some differences are noted by Karny.

Aleurodothrips, Franklin

A. fasciapennis, Franklin-Bagnall, p. 324, A. M. N. H., xv, 1915, among scale insect sp.......*Aspidiotus lataniae*..........................Ceylon, described by Franklin in 1908, p. 727, Proc. U. S. Nat. Museum., xxxiii.

Gynaikothrips, *Zimmerman*=*Chromatothrips*, Schmutz

G. karnyi, Bagnall, p. 28, A M. N. H., xiii, 1914, in marginal leaf galls of pepper...............................Peradeniya. Ceylon.
G. mirabilis, Schmutz, p. 1041, Sitzber. Akad. Wiss,. cxxii, 1913. on *Pavetta hispida*.....................................Ceylon.
G. (*chromatothrips*) *fasciata*, Schmutz, p. 1044, Sitzber. Akad Wiss., cxxii, 1913. Peradeniya. Ceylon.
G. (*chromatothrips*) *annulicornis*, Schmutz, p. 1045 do. do. do.
G. (*chromatothrips*) *plantaginis*, Schmutz, p. 1047 do. Nuwara Eliya. Ceylon.
G. watsoni, Karny, p. 104, Ent. Mitteil., ix, 1920, Bentotta. Ceylon

Cryptothrips, Uzel

C. longus, Schmutz, p. 1054, Sitzber. Akad. Wiss., cxxii, 1913, on *Pavetta*. Ceylon.

This and another *C. pavethae* on p. 1055 above are described as '*Mesothrips*.' Karny considers them to be *Cryptothrips* and synonyms.

Arrhenothrips, Hood

A. Ramakrishnæ, Hood, p. 99, Ins. Insc. Mens., vii, 1919, producing galls in leaves of *Mimusops elengi*, Coimbatore. (Ramakrishna coll.)

Mr. Bagnall in his recent paper[1] considers this insect to be a *Mesothrips* close to *M. lewisi*, *B.*, though Karny disagrees with this view.

Mesothrips, Zimmerman

M. indicus, Bagnall, p. 365, A. M. N. H., vii, 1921, from *Sal* bark. Dehra Dun. N. India.

Mr. Bagnall in his recent paper describes the following *Spp.* of *Mesothrips* from this region.

M. brevis, B., p. 636, A. M. N. H., xiv, 1924, in pepper galls, Ceylon with *Androthrips flavipes*, Sch.

M. angusticornis, B., p. 638 do. do. on bushes, Peradeniya, Ceylon.

M. karnyi, B., p. 639 do. do. in pods of *Albizzia lebbeck* Dehra Dun, N. India.

Ischyrothrips, Schmutz

I. crassus, Schmutz, p. 1076, Sitzber. Akad. Wiss., cxxii, 1913, in *Bauhinia triandra* shoots............Ceylon.
I. obscurus, Schmutz, p. 1074 do. do. do. do. Karny thinks this may be a *Mesothrips*.
I. niger, Schmutz, p. 1080 do. do. do. Peradeniya Ceylon.

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[1] Annals and Magazine of Natural History, xiv, December 1924.

Dinothrips, Bagnall

D. sumatrensis, Bagnall, p. 11, Trans. Nat. Hist. Soc. Northuld, iii, 1908. For synonyms see 'Treubia,' iii, p. 293, 1923. See also p. 203, Phil. Jour. Soc., xvii, 1920. Burma. Philippines.

D. furcifer, Schmutz, p. 1026, Sitzber. Akad. Wiss., cxxii, 1913.............. Peradeniya. Ceylon.

Diaphorothrips, Kerny

D. unguipes, Karny, p. 186, Ent. Mftteil., iv, 1920. Bentotta. Ceylon; also p 299, Treubia, iii, 1923.

IDOLOTHRIPIDÆ

Dicaiothrips, Buffa

D. dalla-torrensis, Schmutz, p. 1067, Sitzber. Akad. Wiss. Vien., 1913 Ceylon; referred to by Karny also, p. 65, Treubia ii, 1921, from Java.

D. proximus, Bagnall, p. 289. A. M. N. H., xiii, 1914, in *Crotalaria* pods. Ceylon.

D. greeni, Bagnall, p. 289, A. M. N. H., xiii, 1914, from decayed pods of *Phaseolus*......................Ceylon.

D. levis, Schmutz, p. 1072, Sitzber. Akad. Wiss., cxii, 1913. Peradeniya, Ceylon.

do. do. Karny, p. 189, Ent. Mitteil., ix, 1920. Puttalam, Ceylon.

D crassiceps, Bagnall, p. 399, A. M. N. H., viii, 1921......................Burma.

D. procer, Schmutz, p. 1063, Sitzber. Akad. Wiss., cxxii, 1913. Ceylon.

D. novus, Schmutz, p. 1066, Sitzber. Akad. Wiss., cxxii, 1913. Ceylon.

D. bruneitarsis, Schmutz, p. 1070. do. do. Peradeniya. Ceylon.

Gigantothrips, Zimmerman

G. tibialis, Bagnall, p. 364, A. M. N. H., vii, 1921, on *Caryea aroborea*.....................Ceylon.

G. spinosus, Schmutz, p. 1078, Sitzber. Akad. Wiss., cxxii, 1913, Ceylon. (This is described as an *Ischyrothrips* by Schmutz.)

Phoxothrips, Karny

P. breviceps. Bagnall, p. 380, A. M. N. H., xiv, 1914........................Simla.

*Kleothrips, Schmutz**= *Dracothrips*, Bagnall (1914) near *Mecynothrips*.

K. gigans, Schmutz, p. 1058, Sitzber. Akad. Wiss., cxxii, 1913. On banana fruit.........................Peradeniya. Ceylon.

K. ceylonicus, Bagnall, p. 290, A. M. N. H., xiii, 1914. Ceylon. (See p. 219, A. M. N. H., i, 1918 for synonymy.)

Idolothrips, Haliday

I. halidayi, Newman, p. 265, T. E. S. 1855 on *Anacardium. sp*........Mysore.

I. Schenklingi, Karny, p. 189, Ent. Mitteil, ix, 1920. Puttalam. Ceylon.

MEGATHRIPIDÆ

Bactridothrips, Karny

B. serraticornis, Bagnall, p. 397, A. M. N. H., viii, 1921, described from one male only......................Pundaluoya. Ceylon.

HYSTRICOTHYIPIDÆ

Leeuwenia, Karny*

L. (*Paneurothrips*) *coriaceus*, Bagnall, p. 216, A. M. N. H., ix, 1912. ....Dehra Dun (N. India); see also p. 640, R.M.N.H., xiv., 1924.

L. indicus, Bagnall, p. 377, A. M. N. H., xiv, 1914 Moulmein, Burma.

L engeniae, Bagnall, p. 640, A. M. N. H., xiv, 1924, on *Eugenia*. Kodaikanal, Pulney Hills.

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* The author has since noted and described a new species of each of these genera in this Journal, see p. 788.

The following is a list of the new forms, described in the forthcoming paper of Dr. Karny on Indian Thysanoptera.

Terebrantia

1. Hydatothrips ramaswamiah, *n. sp.*
2. Tryphactothrips mundus, *n. sp.*
3. Ayyaria chaetophora, *n. gen* and *sp.*
4. Mycterothrips setiprivus, *n. sp.*
5. Anaphothrips oligochaetus, *n. sp.*
6. A. ramakrishnae, *n. sp.*
7. Stylothrips brevipalpis, *n. gen* and *sp.*
8. Ramaswamiahella ? subnudula *n. gen* and *sp.*

Tubulifera

1. Rhynchothrips pallipes, *n. sp.*
2. Dolichothrips ochripes, *n. sp.*
3. Haplothrips ramakrishnae, *n. sp.*
4. Trichothrips hadrocerus, *n. sp.*
5. Eothrips floriiperda, *n. sp.*
6. Androthrips ramachandrai, *n. sp.*
7. Mesothrips melinocnemis *n. sp.*
8. M. apatelus, *n. sp.*
9. Ramakrishnaiella unispina, *n. gen.* and *sp.*
10. Gynaikothrips interlocatus *n. sp.*

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NOTES ON THE BIRDS OF THE SIKKIM HIMALAYAS

BY

HERBERT STEVENS, M. B. O. U.

PART VII

(*Conclusion*)

(*With 2 plates*)

(*Continued from page 685 of this Volume*).

443. The Himalayan Brown Fish-Owl. Ketupa zeylonensis nigripes (Hodgs.).

This form is larger, and on the underparts somewhat paler. Wing 2–3c.m. longer than in the typical '*zeylonensis*.' Dr. Hartert gives the distribution Himalayas, exact distribution not known. Unknown to me, but a *Ketupa* was seen on a few occasions around Hathipota in the Eastern Dooars and could hardly have been referable to this form as it is only likely to be found above the base of the hills, though my largest ♂ (wing of 405) was obtained in the plains of Upper Assam. The wing measurement of typical '*zeylonensis*' is given 39–41·5 c. m. (Hartert).

444. The Tawny Fish-Owl. Ketupa flavipes (Hodgs.).

Recorded for the Lower Himalayas at elevations not exceeding 5,000′. The only specimen that I have seen in recent years is one secured in the Tista Valley by Mr. H. P. P. Barrett. This specimen is in the Darjeeling Museum.

445. The Forest Eagle-Owl. Huhua nipalensis (Hodgs.).

Recorded for the Himalayas at elevations not exceeding 7,000′.

Mai ('Khola') Valley, East Nepal, ♀ 14-4-12, wing 450, obtained along with a single youngster from the nest. The latter became quite one of the attractions to the *paharia* youths who frequented my camp, being accommodated during the day in the nook of a rock, with snug quarters at night, as it was wont to sit at the foot of my stretcher inside my tent, and invariably awakened me with a friendly chuckle. After many vicissitudes and trials from the penetrating cold of these high altitudes to the steamy heat (100° in the shade) of Calcutta in May, and a rough voyage home in the S. W. Monsoon ; it was safely deposited in the Regent's Park Collection where for several years it was an inmate. Mr. G. E. Shaw had one in semi-captivity for many years. Turzum, ♀ 29-5-15, wing 441 (O. Lindgren). Sungma, ♂ 27-12-18, wing 438 (C. E. Brown), procured at mid-day whilst demolishing the remains of a Kalij Pheasant when disturbed by the beaters. Reported to me on a few occasions in the Rungbong Valley, where these two last specimens were obtained at elevations below 5,000′.

446. The Himalayan Scops Owl. Otus scops pennatus (Hodgs.).

Obtained on one occasion only at Turzum, ♂ 29-10-18, at an elevation of 5,200′ (O. Lindgren.), and seen at Gopaldhara on a few occasions at early daybreak and often suspected of being in the vicinity of the Bw., but it is a strictly nocturnal owl, difficult to locate. In this specimen the wing is 140. Coloration : a dark phase, scupulars buff and white mixed, 1st quill longer than the 8th ; 4th quill longest and slightly longer than the 3rd. This bird is evidently referable to Hodgson's '*pennatus*,' but is darker than any specimens in the B. M. from Nepal. *O. s. sunnia* Hodgs., appears to be the bird which is scattered over the plains of Northern India. One very rufous specimen I have, was collected by Mr. C. B. Antram in the Luskerpore Valley in South Sylhet. In this example the 1st quill shorter than the 8th ; 4th quill longest and more pronounced in length to the 3rd than in the previous example.

447. The Spotted Himalayan Scops Owl. Otus spilocephalus (Blyth).

Apparently generally distributed, though few specimens are actually secured. Obtained around Mangpu at 5,000′, above the Tista Valley. (G. E. Shaw).

Nagri, Rungbong Valley, 3,700′, ♀ 11-1-12 (S. F. Boileau.) ; wing 150, ovaries well developed. This specimen agrees well with Assam birds which are very variable in coloration from russet-red to brown, 2 ♂ ♂ wing 142 4 ♀ ♀ wing 142–150, av. 147. Recorded for the Himalayas at elevations between about 3,000′ and 6,000′, but it occurred at lower limits in Upper Assam, being found at the base of the hills. Gopaldhara. Two youngsters brought in 7-7-23 which were safely reared to maturity.

448. The Himalayan Collared Scops Owl. Otus bakkamœna lettia (Hodgs.).

This Scops owl is the commonest nocturnal owl in well-wooded tracts in the Rungbong Valley, and is frequently heard though rarely seen. It appears to occur up to at least 5,000′. Gopaldhara, 4,720′, 24-4-16 ; three almost fully developed youngsters brought in. ♂ 8-7-20, juvenile. ♂ 26-4-21, juvenile ; from which it may be inferred the nesting season is a prolonged period. One specimen was deposited in March 1922 in the Regent's Park Collection.

449. The Larged Barred Owlet. Glaucidium cuculoides cuculoides (Vig.).

This common Owl is widely distributed on the Outer Ranges up to an elevation of over 7,000′. Obtained at Sonada, 6,600′, ♀ 8-2-17. Frequently seen in the Rungbong Valley in broad daylight in open tracts.

450. The Collared Pigmy Owlet. Glaucidium brodiei brodiei (Burton).

Recorded from the base of the hills to a considerable elevation in Sikkim. I have seen it in the deep valleys of the interior at low elevations, and it has been obtained at Gopaldhara around an elevation of 5,000′, where it is occasionally to be met with. The Paharias attribute a call to this Pigmy Owlet, though it is almost an impossibility to locate the quarter from which the sound emanates. On rare occasions I have heard it uttered well on into the morning and frequently at night under the foot-hills in Upper Assam. There is every reason to believe this ventriloquist is the culprit as there appears to be no other feasible explanation of the riddle.

451. The Brown Hawk-Owl. Ninox scutulata lugubris (Tick.).

The specimens obtained in the Tista Valley at an elevation of 2,900′ (G. E. Shaw.) may be referable to this race and not to *burmanica* Hume. Dr. Hartert gives the distribution : India from Rajputana to Bengal. Wing between 205-228, and whereas the exact distribution of *burmanica* is not known ; it is the breeding bird of the Naga Hills in Assam, Cachar and Burma.

452. The Osprey. Pandion haliaetus haliaetus (L.).

I have not been fortunate enough to have seen the Osprey in the Tista River where it is surely to occur. In January 1922, a fine bird was frequenting the Gorge and lower reaches of the Raidak River at the base of the hills ; when on more than one occasion, I had the opportunity of watching its methods of grasping captured fish.

453. The Cinereus Vulture. Ægypius monachus (L.).

Recorded distribution in the ' Himalayas as far east as Bhotan, and there can be no doubt this bird breeds in the Himalayas.'

454. The Black Vulture or Pondicherry Vulture. Torgos calvus (Scop.).

Occurs at frequent intervals in the Rungbong Valley, and may on occasions be seen above the station of Darjeeling where it reaches an altitude of over 7,000′ at all events.

455. The Eastern Griffon Vulture. Gyps fulvus fulvescens Hume.

Recorded as far east as Nepal and Sikkim.

456. The Himalayan Griffon. Gyps himalayensis Hume.

Recorded for the Himalayas from Cabul to Bhotan being confined to the mountains. In the precipitous rocky mountains on the west side of the valley, at an elevation of 10,000′ upwards, above Lachung, in March 1920 ; I daily observed a huge congregation of several species of vultures which were undoubtedly breeding. They were never seen away from these haunts around which they sailed in majestic fashion. Mr. A. F. R. Wollaston during the

Mount Everest Expedition mentions seeing it in the gorges of the main Himalayan Range, up to 14,000′, but not on the Tibetan plateau, where only *Gypaëtus barbatus grandis* occurred.

457. The Himalayan Long-billed Vulture. Gyps indicus tenuirostris Hodgs.

Recorded throughout the Lower Himalayas and near their base. Evidently occurs in Sikkim as Blanford quotes the Lepcha name.

458. The Indian White-backed Vulture. Pseudogyps bengalensis (Gmel.).

Recorded, "not found above moderate elevations in the Himalayas." It appears to ascend to *over 8,000′ on the Outer Ranges* at which elevation, a ♀ was obtained in the Mai 'Khola' in East Nepal on 24-3-12. This bird was knocked over by some youths, when on the ground, and brought into my camp at 10,160′, it was a juvenile with black bill and dark back. At varying periods, three other species of vultures were seen in some numbers, which in many cases appeared to be *Gyps himalayensis*, none were obtained with this exception as I must confess to an avowed aversion in the preparation of vultures' skins. Gopaldhara: I disturbed a single bird on my way home on the evening of 6-3-18; which had evidently settled for the night in a cryptomeria tree below the compound, 4,720′. I identified the vultures, which were breeding in January 1922 in the village of Kumargram in Eastern Bengal, to be this species, judging by their roaring though I failed to observe the white parts of the adult. For a better acquaintance with this group of birds, no more advantageous place for observation in the hills can be afforded than the municipal slaughter house at Darjeeling, where there is every chance of meeting with all the species that occur in the district. The whole surrounding ground is in occupation of vultures with kites and crows in attendance. The late Mr. J. L. Macintosh availed himself of this opportunity, and did not miss the humorous side of their habits in his description of their jaunts on the wire-ropeway which carries the refuse to its destination. It requires the enthusiasm of an ardent ornithologist but the results would justify the olfactory inconvenience.

459. The Bearded Vulture or Lammergeyer. Gypaetus barbatus grandis Storr.
'Lhema gida' Paharia.

There can be few more impressive sights in connection with any bird, than to be fortunate in seeing the majestic Lämergeyer proudly keeping ahead of an approaching storm, as the clouds roll along the ridge with an enveloping mist or whilst under more favourable circumstances, it soars at an intense height over the sublime depths of the valley below. They appear to have regular beats along the ridges and spurs, and at the close of the breeding season, extend over a wider area, as single birds may be seen as far out as Mirik or Kurseong, though I have no record of their descending to a lower limit than 4,800′ when on one occasion it was observed flying leisurely above my home on 29-6-18. I have seen it on the Outer Ranges, Phalut, 11,811′, 17-2-12. Sandakphu, 11,923′, 8-3-12; when one passed overhead several times in company with vultures, and on this and similar occasions its curiosity was so aroused as I reclined on the ground to bring it within measurable distance, when the rich ferruginous tint of the breast feathers, and piercing eye, heightened by the blood-red membrane were seen to perfection. I have never seen more than a solitary bird on any one occasion,[1] which trait in its habits, almost discounts any near relationship with the vultures. Mr. H. P. P. Barrett informs me, whenever it appears with the latter at their feeding grounds it keeps aloof from the common herd. One specimen he obtained had its gullet and stomach crammed with undigested bones. This well-known fact prompted me to test the extent of the Bungalow *chaukidar's* knowledge at Sandakphu in reference to its habits, and as the old man vividly described what he had witnessed; I was content to let him have his final assurance that this bird was no ordinary '*Gida.*' It occurs frequently over Ghoom and was noted daily in the Lachung Valley in March, when an adult bird was wont to wend its flight down the valley. I have only once seen it settle in a tree and remain there for some time. They seem to spend only brief intervals on the ground, when they are attracted to their favourite repast. One adult ♀ was obtained in this manner by trapping near Kurseong on 11-1-20, wing, 830. Soft parts : Iris pinky yellowish-white ; sclerotic membrane blood-red ; bill horny, tip dark ; tarsus plumbeous-grey, stippled with oxide of iron ? Kalo Pokhari, camp, 10,160′, ♂ 24-5-12. This specimen was in extremely ragged condition ; as it was in the so-called immature plumage ; some years must elapse before the full adult garb is attained, otherwise this record nullifies the usual accepted data in regard to this phase being a mark of the young bird. To me it seems akin to a melanistic phase. This bird in its dark plumage and blackish-brown head in flight appeared like a huge *Ictinaëtus*. Wing abraded. Soft parts : Iris stone-yellow ; sclerotic membrane, dull orange ; gape, blue.

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[1] I have since seen three birds soaring at an immense height over the Gopaldhara Bw. 7-5-23. This occurrence most likely pointed to adverse conditions in the weather in the high upper regions.

Mr. A. F. R. Wollaston records seeing this bird flying at a height of not less than 24,000, during the Mount Everest Expedition.

460. The Eastern Steppe Eagle. Aquila nipalensis nipalensis Hodgs.

Blanford gives the Lepcha name for this Eagle. Mr. G. E. Shaw appears to have obtained it at Mangpu at 3,860′. Probably occurs with more frequency in the Tista Valley than in the minor valleys on the west. As these large Eagles have so many different phases of plumage, and opportunities seldom come one's way in the well-wooded country of the Eastern Himalayas for observation, I am unable to fix the identity of a few aquiline birds which have come under my notice which at sight appeared to be referable to this species.

461. Bonelli's Eagle. Hieraetus fasciatus fasciatus. (Vieill.).

It is with some diffidence that this fine Eagle is included in this list as, so far, I have seen no specimen from Sikkim, or the lower foot-hills, though this country is well within its recorded distribution. My observations point to its having some status, but until specimens have been actually obtained, its inclusion only rests on circumstantial evidence. The National Collection is represented by two specimens from Nepal (Hodgson and Scully) and one from the Bhotan Dooars collected in March 1875 by Mandelli. *Hieraaëtus pennatus* (*Gmel.*) by one Sikkim skin, dated 1872, in the Hume collection and one specimen from Nepal collected by Hodgson. My thanks are due to Mr. N. B. Kinnear for supplying me with this infoımation.

462. The Rufous-bellied Hawk-Eagle. Lophotriorchis kieneri (De Sparre).

This grand bird is apparently confined to the Tista and Great Rangit Valleys, occasionally straying to the surrounding hills. Reported to me as known by a few careful observers, and within recent years has been obtained at Bannockburn Estate at 5,000′, ♂, 18-4-18 by the late Mr. E. A. Wernicke and a ♀ below Mangpu at 3,300′ on 31-8-20 by Mr. G. E. Shaw. Observed at Gopaldhara at about 4,000′ in the Rungbong Valley on 9-2-19 when the rich ferruginous underparts were prominent, and a wild resounding call was uttered on its taking flight.

463. The Indian Black-Eagle. Ictinaetus malayensis perniger (Hodgs.).

The Black-Eagle has recently been recorded at the foot of the hills at 500′ by Mr. C. M. Inglis. It is generally distributed at elevations of from 2,000′—10,000′, on the Outer Ranges and occurs in the Interior around Gangtok at 5,800′, in February and March. I have noted its appearances, which have attracted my notice, though excepting the period, when it is occupied in breeding ; it is often to be seen leisurely quartering the wooded 'kholas' of the hill-sides. Gopaldhara, occasionally seen in January 1912. Observed the first week in July 1914. On 13-5-16, pursued Drongos (*Chaptia ænea*), several of which are addicted to mob it daily, as it appears on its rounds. Sandakphu, 11,923′, 1-3-12, several hereabouts. In flight it shows some resemblance to the laboured motion of the Marsh Harrier ; this trait is more noticeable as it passes overhead than from a broadside aspect.

Four specimens examined : Rungbong Valley, Sungma, 4,500′, ♂ 29-9-14, (C. E. Brown), wing 572. Nagri, 4,300′, ♂ 11-2-16, wing 576. Gopaldhara, 6,000′, ♀ 4-11-19, wing 580 'worn' ; a broad patch of white on the throat extending behind the ear-coverts with the chin and a gular stripe black, otherwise in the rich deep black plumage of the adult female. The gullet and crop contained the carcases of six or more young field-mice. Balasan Valley, Pussimbing, 4,500′, circum. ♀ 15-12-15, wing 585.

Soft parts : ♂ Iris stone-brown ; cere deep ochreous-yellow ; base of bill greenish-yellow ; bill black ; tarsus ochreous-yellow ; claws black.

♀ Iris brown ; cere and gape gamboge-yellow ; bill basal half, yellowish-green, remainder bluish-black darkening towards the tip ; tarsus dark ochreous. ' *A Synopsis of the Accipitres* ' (Kirke Swann.) gives the measurement of the wing, as 550–600.

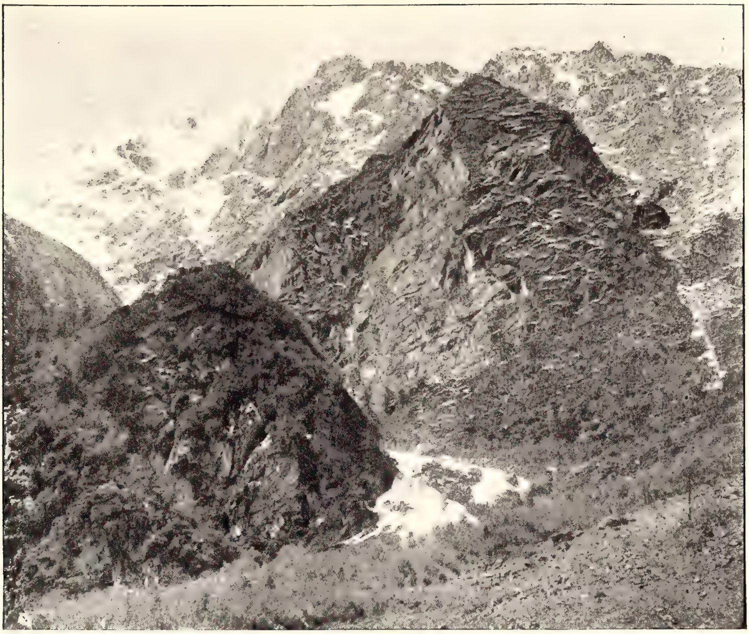
464. The Himalayan Hawk-Eagle. Spizaetus nipalensis nipalensis (Hodgs.).

This bold and aggressive eagle is the great terror of the country-side. It is generally distributed in the forested tracts at elevations of from 2,500′–10,000′ on the Outer Ranges. Often to be seen around Gopaldhara. Being a wary bird, it is difficult to obtain. Sungma, 4,500′, ♀ 10-1-12. Sandakphu summit, 11,800′, 8-3-12. This day, I was the witness of the manœuvres of a pair of these grand birds, as they were too wary to allow of a near approach, I had to be well content with the excellent view attained from a secluded vantage point amongst the rocks. At times they remained stationary in the clear atmosphere, hovering perceptibly against the wind, occasionally making some terrific dashes in a down-ward direction, closing the wings at each attempt ; in one instance this feat was performed by a single bird as it came to roost on the topmost, naked branch of a tall, commanding pine-tree ; but more frequently these acts were performed in combination, in true exuberance of spirits. Ambootia, 3,000′ approx., 18-4-15. I watched a prolonged bout in mid-air at a great height up, between a pair of these eagles endeavouring to seize a domestic pigeon, which eventually escaped after an exciting time to the accompanied shouts of the owner of the bird to which the eagles were oblivious. Nigali, 5,000′ approx., 28-1-16 ; a Kite (*Milvus lineatus*) was brought in to me with its throat ripped open by one of these eagles, the combat, which took place in mid-air, was witnessed by my informant. Gopaldhara, a large ' utis ' tree adjacent to the bungalow has been a favourite roosting place on more than one occasion and a date against this fact is 18-9-15*. Seen to take a Kalij Pheasant from the ground and carry it away with perfect ease. Three specimens examined : Ghoom, 6,500′, ♂ 18-1-19, wing 462 ; the whole of the lower parts from the chin to the under tail-coverts without streaks or bars. ♀ the pair to this male, is in a melanistic phase, with black head and bars on the tail well defined, throat and breast with heavy dark streaks, and the whole of the lower surface dark and barred throughout to the under tail-coverts, wing, 465. Rungbong Valley, 10-1-12, ♀ wing 432 ; this appears to be a younger ? bird but with crest fully developed, gular stripe on throat and streaks on breast well defined, lower parts pale with barring on the flanks, abdomen, thighs and under tail-coverts also prominent. Kirke Swann gives the wing measurement of this form as ♂ 450–460, ♀ 485–495. In my ' Notes on the Birds of Upper Assam ' I recorded a ♂ from Dejoo, N. Lakhimpur, 30-11-08, under this species which on further examination is referable to *Spizaëtus cirrhatus limnaëtus* (Horsf.), being the pale phase (*S. caligatus* Raffles). This species appears to be restricted to the Lower Himalayas along the base of the hills ; the wing in this specimen is 440.

465. The Crested Serpent Eagle. Spilornis cheela cheela (Lath.).

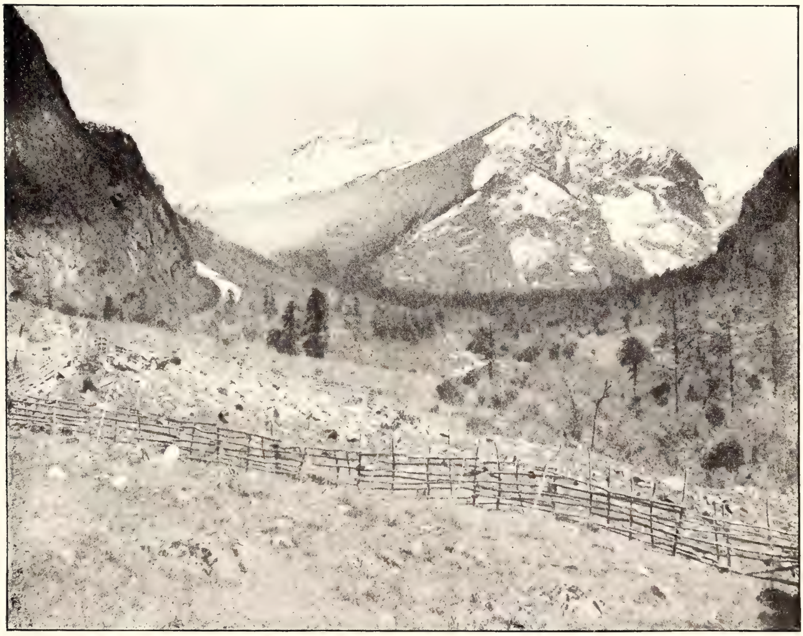
A common and generally distributed eagle. It occurs on the Outer Ranges and well into the Interior, where I have observed it around Singhik in the Tista Valley. Amongst the numerous occasions it has come under my notice, the following records have been duly noted. Gopaldhara, 4,720′, 7-4-19. * Turzum, 5,200′, one secured, minus one tarsus, on 25-7-17. (O. Lindgren.) 25-2-21, ♂ wing 495. Seeyok, ♂ 31-3-20, wing 493. Thurbo, ♀ 1-5-21, wing abraded.

Kirke Swann gives the wing measurement of this form as ♀ (Himalayas) 495–532, ♂ 500–510 and that of *S. c. albidus* (Temm.) ♂ (Assam) 430–443 ; ♀ 430. I find five ♂♂ measure (a) 405, (b) 455, (c) 460, and (d) 485 respectively whilst a single ♀ measures only (e) 415. Some of these low wing-measurements for Assam specimens are significant. Whilst the single female (e) refers to an adult in typical dark plumage, male (a) is in the pale phase ; throat entirely white, breast white with centre streaks, abdomen banded, head and nape showing a preponderance of white, upper surface fringed with white ; (c) is a



H. S. Photo.

CRAGS, NORTH-WEST OF LACHUNG VILLAGE.
Haunts of Vultures sp.?, *Pyrrhocorax graculus*, *Grandala cœlicolor*, &c.
7th March, 1920.



H. S. Photo.

LACHUNG VALLEY ABOVE THE VILLAGE.
Looking north. "An excellent example of a glacial valley."
Pines in foreground chiefly *Abies smithiana*, the Spruce of Hooker.
Haunts of *Pyrrhocorax pyrrhocorax*, *Columba leuconota*, &c., &c. 7th March, 1920.

still paler bird which almost discounts this phase of plumage being a mark of immaturity. Stuart Baker restricts *albida* to Southern India. Kirke Swann gives the distribution of this form.—E., C. and S. India from Assam to Travancore; whereas Kirke Swann restricts *rutherfordi* to Hainan Isl. and French Indo-China. Stuart Baker gives the distribution of this form.—Assam, Burma and Siam to Hainan Isl. My specimens show much disparity in size and thus best agree with the last-mentioned distribution.

466. The White-eyed Buzzard-Hawk. Butastur teesa (Frankl.).

The only record for this species is that of a ♂ obtained at Mangpu, 3,800′, on 19-2-21. (G. E. Shaw). A bird seen at Chungthang on 11-3-20* appeared to be referable to this *Butastur*, as it was not secured, this occurrence lacks substantiation. Blanford refers to this species as wanting in the Himalayas. The above record is apparently *an extension of its distribution area*.

467. Pallas's Sea Eagle. Cuncuma leucorypha (Pall.).

Obtained on one occasion in the Rungbong Valley at Sungma 4,500′, ♂ 16-6-19 (C. E. Brown.), wing, 585. Kirke Swann gives the wing-measurement of this species: ♂ 563–573; ♀ 600–618.

468. The Brahminy Kite. Haliastur indus indus (Bodd.).

Apart from a few birds occurring in the cold weather, there appears to be an influx into the hills of this kite on the advent of the S. W. Monsoon. Obtained at Turzum at 5,200′, ♂ 11-12-21. (O. Lindgren.) Gopaldhara, a single bird seen on 8-4-19, and a pair in evidence at Nigali, 5,200′, on 14-6-15. This kite ascends to 7,000′.

469. The Indian Kite. Milvus migrans govinda Sykes.

Recorded as 'found in the Himalayas up to an elevation of about 12,000′, but is uncommon above about 8,000′.' I have identified this kite from a few low elevation specimens, Nurbong, 2,000′, 18-3-14. I picked up a bird with a wing-measurement of only 13⅞″ = 350, and I have received specimens from Thurbo in January 1916, and from Sungma, 11-5-15, wing, 19″ = 483.

♂ Wing, 430–450. ♀, 460–480. (Kirke Swann.).

Blanford records this kite from Lachung, 8,000′ and Yumthang, 12,000′, (September). All the birds I saw in Lachung in March were referred to the next species.

470. The Black-eared Kite. Milvus lineatus (Gray).

The following information has reference to this large kite. I have neglected to obtain specimens, since a number were obtained in Assam. Balasan Valley, Namsoo, 2,000′. Observed in some numbers frequenting the river-bed in the first week in January 1912. Kalo Pokhari, Nepal-Sikkim Frontier, 10,160′, 29-3-12. Not much in evidence at these heights but a single pair seen to-day and a solitary bird on 1-4-12. Jalapahar, 7,500′ circ., 9-4-17. Numerous kites congregating hereabouts, disporting in a high wind on a bright afternoon. Lachung, 8,800′, 9-3-20. Numbers in evidence around the village. During the Mt. Everest Expedition observed in the Kharta Valley up to 17,000. (A. F. R. Wollaston). ♂ Wing 475–485; ♀ 500–530; tail 300–335. (Kirke Swann).

471. The Indian Black-winged Kite. Elanus cæruleus vociferus (Latham).

During the early summer in 1921 there appeared to be an extension of this kite into the hills, as both Mr. O. Lindgren obtained it at Turzum in May at 5,200′ in the Rungbong Valley and Mr. G. E. Shaw below Mangpu at 3,700′, ♀ 15-4-21; 3,800′, ♂ 16-4-21.

472. Montagu's Harrier. Circus pygargus (L.).

Evidently occurs sparingly in the Rungbong Valley during the 'cold weather.' Turzum, 5,200′ circ., ♀ 12-1-21 (O. Lindgren.), wing 338; both ovaries well defined. Iris brown; bill black; tarsus yellow; claws black. As will be noted from the wing measurement this bird is a diminutive specimen. ♂ Wing 350–370, (one 340 and one 380 mm.) ♀ wing 350—380 (one 335). *British Birds, vol. ii, p. 153*, Witherby.

473. The Pallid Harrier. Circus macrourus (S. G. Gmel.).

This harrier most likely occurs under favourable conditions in 'the cold weather.' On the west side of the Rungbong Valley, all harriers give the wooded tracts a wide berth, and on no single occasion, have I ever seen a bird on Gopaldhara ; yet they occur in the valley fairly frequently, but much more commonly on the bare, open ground around Pokharibong and Mirik.

474. The Hen Harrier. Circus cyaneus cyaneus (L.).

This harrier is probably the commonest of all the members of this genus, Rungbong Valley, Selimbong, ♀ 20-1-16, wing, 398. Iris gamboge-yellow ; this specimen is a fine adult bird. A female observed at Mirik, 29-3-20.

475. The Pied Harrier. Circus melanoleucus (Forst.).

I have seen it on a few occasions, and it has been reported to me at other times. It evidently extends into the hills, covering a wider area in 'the cold weather.'

476. The Long-legged Buzzard. Buteo ferox ferox (S. G. Gmel.).

This buzzard appears to be more common in the North-West, than in the Eastern Himalayas. Recorded for Sikkim, and I obtained it under the hills in Upper Assam. A further examination proves the specimen to be the typical form. It is quite impossible to distinguish between adults in the pale phase of this species and *Buteo japonicus* = *B. plumipes* (Hodgs.), unless they are available for comparison, when the former shows a more decided ferruginous coloration generally ; which is pronounced on the tail, the inner webs of which have a preponderance of white. Birds from the eastern limits of its range appear to have the naked portion of the tarsus in front reticulated and not scutellate as in European examples. Buzzards seen on several occasions on the Singile La Ridge during the winter of 1911–12, in particular near Phalut on 16-2-12 and 19-2-12, some of which were dark coloured birds, and at Sandakphu, 15-3-12, and Kalo Pokhari in March 1912 ; which latter records to refer to very pale birds may have in some cases been this species, though no definite certain indentification was possible, and this remark applies to birds seen on various occasions at much lower limits.

477. The Upland Buzzard. Buteo hemilasius Temm. & Schleg.

Dr. Hartert treats this buzzard as a race of *B. ferox* and *Buteo leucocephalus* and *Archibuteo strophiatus* (Hodgs.) are synonyms. Both these two latter birds have been recorded from Sikkim. On Sandakphu, 3-3-12, I saw a large bird with a dark head, inclined to black, breast distinctly ferruginous, tail much rounded ; as it soared overhead it uttered a plaintive, mewing cry. To all appearances it seemed too large for a buzzard but might have been this species. The few small birds in the gully below which, at the time, I was watching were a pair of Redstarts (*P. schisticeps*) a Wren (*T. nipalensis*) and several Cole-Tits (*L. rufonuchalis beavani* and *L. dichrous*), but these suffered no molestation, whilst busily occupied in and about the dwarf rhododendron bushes.

478. The Japanese Buzzard. Buteo japonicus (Temm. & Schleg.).

This is the *B. plumipes* (Hodgs.). Kirke Swann queries the Himalayas in his, distribution key. Rungbong Valley, Turzum, 5,000′ circ. ♂ 18-11-19, wing, 380. This example is in the stage of plumage which is probably referable to a not yet adult bird and has the zone on the abdomen, which Kirke Swann has very aptly compared with *lagopus*. Iris stone yellow (pale brown) ; ceregreenish yellow ; bill slaty-black ; tarsus scutellate in front, dull ochreous. Stomach contained remains of a mouse, some Orthoptera and a skink in the gullet. 5,200′, ♀ 16-2-21, an adult, wing, 412. Very similar to some specimens of *B. ferox* without the rufous markings, tail uniformly dark. Iris pale stone-brown ; cere greenish ochreous ; bill black ; tarsus reticulate in front, dull ochreous ; claws black. Stomach contained remains of a field-mouse and a chameleon. Lachung, 10,000′, ♂ 3-3-20, wing, 360 ; this example has the bare portion of the tarsus reticulate in front, and is in a melanistic phase of plumage throughout. Several buzzards were seen in this Valley, when on occasions they have been observed to descend with closed wings in a terrific swoop but which calmy ended by settling on a tree-stump or other equally accommodating perching site. This buzzard is frequently to be seen in the Rungbong Valley during the 'cold weather,' and I saw a fine pair of birds at Mirik, which had taken up their quarters in a lofty tree adjacent to the swampy ground in the winter, 1921-22; when odd birds were to be seen around Gopaldhara, a specified date being 28-10-21. Blanford records it from Yumthang, 13,000′. (September).

479. The Siberian Goshawk. Astur gentilis schedowi Menz.

The only specimen that I have seen from these hills is a ♀ obtained on the 18-11-18 at Sungma, 4,500′ in the Rungbong Valley by Mr. C. E. Brown, to whom I am indebted for many interesting *Accipitres*. The wing of this example measures 337, tarsus 83. It is richly suffused with cream colour and heavily blotched on the underside so, is apparently in the immature stage of plumage. This bird was molested by a pair of Jungle-Crows, being driven from tree to tree. Iris bright golden-yellow; cere greenish-yellow; gape yellow; bill, bluish, shading towards tip into black; tarsus, lemon-yellow; claws black. Stomach contained only two small fragments of micaceous gravel, being absolutely empty of any food.

480. The Shikra. Astur badius dussumieri (Temm.).

The Shikra breeds at moderate elevations and is generally distributed. After an examination of my material from the Eastern Himalayas, I can detect no differences from extreme limits, which are not explained by *seasonal change*, and my conclusion is that all these birds must be relegated to one form. *A. b. poliopsis* (Hume.) is said to be darker grey above; with broader and brighter vinous bands below whilst *A b. dussumieri* is above lighter grey, below paler rufous in comparison with the typical form (Kirke Swann); there is apparently no difference in the size of these two forms, which are larger than *A. b. badius* (Gmel.).

Adult males, all very similar on upper side.

Sikkim Himalaya. Rungbong Valley, Turzum, 5,200′ circ., ♂ (*a*) 8-3-19. (O. Lindgren.), wing 182. Iris crimson; bill bluish at gape, sheath, horny bluish-black, deepening towards tip; cere bluish and yellowish on top of culmenal base; tarsus dull yellow; claws black.

Sungma, 4,500′, ♂ (*b*) 2-4-20 (C. E. Brown), wing 186; the palest example of all, gular stripe best defined. Iris orange-yellow; bill bluish at base, varying to the dark tip, cutting edge of upper mandible yellow; cere bluish-yellow; tarsus dusky-yellow; claws black; testes active. Stomach contained remains of *Leiothrix lutea calipyga*, identified by the bill, which was intact.

Upper Assam. Dibrugarh, Rungagora (Plains), ♂ (*c*) 4-7-03, wing 187. Iris crimson; the darkest example of all, traces of the bars indicated on the thighs, otherwise showing the white under tail-coverts as in the rest. Sibsagar, Komilabari (Plains), ♂ (*d*) 1st-13-9-04, wing 178, bars not as deep in colour as (*c*) but brighter than (*a*), identical with an example from the Luskerpore Valley, South Sylhet, month not noted, wing 190.

Immature males, all showing the rufous fringes to the feathers of the upper side, and bloched below.

Upper Assam. N. Lakhimpur, Dejoo, ♂ 23-7-04, wing 191, ♂ 5-8-04, wing 188; ♂ 10-8-07, wing, 192. Iris pale yellow; the darkest example in this series.

Sikkim Himalaya. Rungbong Valley, Gopaldhara, 4,700′, ♂ 5-8-20, wing 182. Iris pale yellow.

Adult females, all very dark on the under side with the head slaty in example (*h*) which is brownish-slaty in the rest; bars on thighs well defined in (*g*), only faintly indicated in (*h*); gular stripe most prominent in (*f*).

Sikkim Himalaya. Rungbong Valley, Gopaldhara, 4,700′, ♀ (*e*) 15-7-16, wing, 209, a breeding bird, tail in heavy moult. Sungma, 4,500′, ♀ (*f*) 7-8-17 (C. E. Brown.), wing 214, a breeding bird, tail in moult.

Upper Assam. Nth Lakhimpur, Dejoo, ♀ (*g*) 15-9-08, wing 216. ♀ (*h*) 21-10-08, wing, 214.

Immature females. *Upper Assam.* Nth. Lakhimpur, Dejoo, ♀ 2-8-04, wing 208. *South Sylhet.* Luskerpore Valley, ♀ wing 207. *Sikkim Himalaya.* Rungbong Valley, Gopaldhara, 4,720′, ♀ 18-9-21 wing 201. Iris pale yellow, cere greenish-yellow; bill black at tip, gape and basal half of lower mandible, bluish; tarsus dingy-yellow; claws black. This bird flew into the bungalow verandah at 3 p.m. in a bold endeavour to seize a caged barbet.

481. **The Larger Crested Goshawk. Astur trivirgatus rufitinctus** McClell.

Recorded for Sikkim, but apparently occurs more commonly farther to the east and is evidently a bird of low elevations. Mandelli obtained it breeding at Mantchu ? (Namchi) in May.

481 (*a*). **The Larger Besra Sparrow-Hawk. Accipiter affinis** Gurney.

This Sparrow-Hawk occurs, yet is apparently far from common. Turzum, 5,200′, ♀ 28-12-15. (O. Lindgren.) wing 203, tail, 156, this example is a fine adult bird. Gopaldhara, 6,000′, ♀ 5-11-19, wing 196; tail 138; this last example is an immature bird; both specimens were obtained in the Rungbong Valley. A female observed in December 1911 near Thurbo at 4,600′ was certainly referable to this species.

482. **The Indian Sparrow-Hawk. Accipiter nisus melanoschistus** Hume.

An examination of my material is detailed, as it seems to me impossible to separate this form from *nisosimilis* as far as cold-weather birds are concerned. The measurements overlap and colour differences are an unstable guide-due to age and seasonal change. The distribution of the two races appears to be not yet clearly defined, especially if the two forms intermingle in their winter limits; if this is the case; there must be some confusion in an exact determination.

Nepal-Sikkim Frontier, Kalo Pokhari, 10,160′, (*a*) ♂ 22-3-12, wing 204; tail 142; this example is an adult. Iris orange-yellow. Upper parts dark slaty, head still darker and the whole of the lower surface rusty-red, obliterating the bars, excepting on the abdomen and flanks.

Rungbong Valley, Thurbo, 4,500′, (*b*) ♂ 25-1-16, wing 212; tail 143, not quite as dark as the previous example, bars on the under surface defined and suffused with rufous.

Upper Assam, N. Lakhimpur, Dejoo, ♂ (*c*) 2-12-10, wing 216, tail 150.

Similar to (*b*) lower surface strongly suffused with rufous; bars distinct. Dibrugarh, Rungagora, ♂ (*d*) 6-4-03, wing 205; tail 142; an immature example in abraded plumage. ♂ (*e*) 26-1-04, wing 216; tail 150; an immature example in fresh plumage.

Sikkim, Lachung, 10,000′, ♀ (*f*) 3-3-20, wing 253; tail, 183. Left ovary developed, stomach empty. *On migration*, held up with a snow storm. This example is the darkest of six females, and has the head almost black, yet this bird was accompanied by the next specimen which is equally adult ♀ (*g*) but which is correspondingly in a lighter phase of colouration, wing 247; tail 162; both ovaries showing signs of activity, stomach empty.

Rungbong Valley, Thurbo, 4,500′, ♀ (*h*) 28-11-20, wing 253; tail, 169; head and nape showing more white than is usually present in adult females, with the under surface and bars dark and well defined. Attracted to the precincts of the bungalow by the Pigeons. ♀ (*j*) 24-12-21, wing 240; tail, 156; an immature bird in fresh plumage, ♀ (*k*) 20-1-19, wing, 258, tail, 180; a fine adult bird with the head dark slaty, contrasting with the back and wings which are a slaty-brown; an altogether paler phase than (*f*). Gopaldhara, 3,500′. ♀ (*l*) 30-1-19, wing 245; tail, 160, evidently an immature bird in slightly abraded plumage. Males Nos. (*b*) & (*c*) in comparison with (*a*) and female (*k*) in comparison with (*f*) might be referred to *A. n. nisosimilis* (Tick.) provided the specimens with which they have been compared are typical and in normal plumage,—not the result of excessive vigour or a phase of melanism.

Blanford refers to a sparrow-hawk as common in the Lachen and Lachung Valleys after the middle of September, evidently migrating southward but none were seen on the Cho La Range at the end of August 1870.

483. **The Indian Crested Honey-Buzzard. Pernis cristatus ruficollis** Less.

This Buzzard occurs with frequency in the hills at *moderate elevations*. An adult ♀ obtained in the Rungbong Valley in late March 1912. Wing 452; underparts more white than cream-coloured with the streaks well defined on the breast. Sungma, 4,500′, ♀ 14-10-19 (C. E. Brown.), this example is a very fine adult bird, showing a rich creamy suffusion over the whole of the lower surface, particularly marked on the breast; the streaks are well defined. Wing 448. Soft parts: Iris gamboge-yellow; bill greenish-plumbeous at base of both mandibles, upper mandible plumbeous-black, darkening towards the tip; lower mandible bluish-plumbeous darkening similarly; tarsus dusky-yellow.

A few observations have been duly noted. Gopaldhara, 9-10-16.* A kestrel seen in company with a honey-buzzard when the former was observed to harrass it, but this act could hardly amount to a serious effort as it was glorious weather at the time and seemed to be more of an ebulition of spirits in sheer delight; even the Butterflies (*Papilio philoxenus*) which usually flitted about the compound at no great height, were this morning disporting some hundreds of feet above their accustomed realm, when they appeared like dimunitive birds in the clear atmosphere. Nagri Spur, 31-3-17*. Mangpu, 3,800′. ♂ 5-5-20; ♂ 13-8-21. (G. E. Shaw). For comparison my specimens from Assam, 3 ♀♀ Wing, 412, 415, 432, ♂ 398. The measurements of my adult birds exceed Kirke Swann's: ♀ 405-418, ♂ 380-390.

484. The Black-crested Baza. Lophastur leuphotes leuphotes (Dumont).

Sparingly distributed and confined to *low elevations*. Reported to me from few localities but evidently breeds on the Nagri Spur at an elevation not higher than 4,250′. Two specimens examined from this locality for which I am indebted to Mr. E. G. Birch. ♂ 26-6-19, wing 232; tail 122; bill from cere, 18; tarsus 36. Iris hazel; bill plumbeous-blue, darker at tip; tarsus plumbeous; claws plumbeous-horny. ♀ 10-7-20, wing 242; tail 128; bill from cere, 18, tarsus, 34. Iris, brown; cere, dark bluish-plumbeous; bill, pale-blue, tip and edges of notches of upper mandible dark; tarsus, pale bluish-plumbeous; claws dark horny. Stomach contained insect remains entirely—grasshoppers and caterpillars.

485. Blyth's Baza. Aviceda jerdoni jerdoni (Blyth).

Recorded from Kurseong, 6,000′, by Mr. E. A. D'Abreu and by Mr. A. M. Primrose from the foot-hills, 1,200′-2,000′, in this Journal, vol. xx, pp. 518 and 1152, respectively. It has since been obtained by Mr. G. E. Shaw at Mangpu, 5,500′, ♂ 13-12-20.

486. The Indian Hobby. Falco severus indicus A. B. Meyer & Wiglesw.

The only specimen obtained in recent years to my knowledge was shot by the late Mr. E. A. Wernicke at Bannockburn Estate below the station of Darjeeling. Observed in lofty forest on the left bank of the Raidak River in January 1922.

487. The Central Asian Hobby. Falco subbuteo centralasiæ (Buturlin).

The typical form appears to be a winter visitor to North-West India, where my specimens have been obtained. Until the following specimens from these hills have been compared, it is impossible to decide whether they refer to this form or *F. s. streichi* Hart. & Neum. Mangpu, 3,850′, ♂ 3 10-18. ♂ 11-10-19. (G. E. Shaw.). Both of us observed a hobby to take up its position in the trees facing the bungalow at Mangpu on 16-10-18* when its identification was fixed. Observed at Gopaldhara on 19-10-18* and again at 3,700′, 7-2-19*, single birds on both occasions.

488. The Eastern Red-footed Falcon. Falco vespertinus amurensis Radde.

A single ♀ obtained at Mangpu at 3,860′, on 18-10-18, (G. E. Shaw.) is the only record that I am aware of for these hills within recent years.

489. The Himalayan Kestrel. Cerchneis tinnunculus saturatus. (Blyth.).

490. The Eastern Kestrel. Cerchneis tinnunculus subsp. ?

So far as can be ascertained, no reason has been cited for the acceptance of McClelland's *interstinctus* in place of Blyth's *saturatus*. McClelland's type came from Assam, where two or more races are likely to occur. While some of my skins from the Sikkim Himalaya are without doubt referable to *saturatus*; this appears not to be the case with my Assam skins, as the majority of my specimens are not 'saturatus.' This kestrel is resident in the Rungbong Valley, and breeds sparingly around Gopaldhara from 5,000′ upwards. It seems to lay fewer eggs in the clutch than the typical form. A single youngster, taken from the nest in early 1915, either in March or April, was a female. This bird is now in the Regent's Park Collection.

Six specimens examined: Gopaldhara, 4,720′, ♀ 16-1-12, wing and tail in heavy moult. Thurbo, 4,500′, ♂ 20-8-21, wing 243; tail 146, first two primaries in process of growth. ♀ March 1919, wing 259; tail 150. ♀ 22-11-21, wing, 234; tail, 132; wanting the deep rufous suffusion on the breast, probably not fully adult, otherwise agrees with the rest, in the average run of coloration; noted to be in fat condition.

Turzum, 5,000′, ♀ 17-9-20 (O. Lindgren.), wing 253; tail 144, not fully adult. ♀ 8-11-20, wing 257; tail 149, a fine adult bird; stomach contained Diptera Larvæ and parasitic filariæ.

My Assam specimens and with these are included one ♂ from the Sikkim Himalaya, approach nearer to *japonicus* Temm and Schleg., in coloration, but are far too large for this race, yet at the same time are too small for *dorriesi* Kirke Swann. Another race has been described from Fusan and Corea, 1907:—*perpallida* Clark.

The measurements of my specimens are detailed.

Assam.	♂	Wing	250;	tail	149	(November), Immature.
,,	♂	,,	250;	,,	141	(April), in change of plumage.
,,	♂	,,	258;	,,	143	(December), Adult.
,,	♂	,,	256;	,,	158	(November), Adult.
Sikkim.	♂	,,	255;	,,	149	(January), Adult.
Assam.	♀	,,	254;	,,	156	(November), Immature.
,,	♀	,,	258;	,,	147	(April), Adult.

This series I consider to be well removed from '*saturatus*' and sub-specifically underterminable. The elucidation and correct identification of these eastern forms is most desirable. Numbers of kestrels are to be seen during 'the cold weather' at moderate elevations in these hills, and a few pairs were observed in the Lachung Valley up to 9,000′ at a similar period of the year, where Blanford records first seeing it on the 9th of September when it made its appearance a few days sooner than the sparrow-hawk, which evidently refers to the cold-season migrant.

491. The Red-breasted Pigmy Falcon. Microhierax cærulescens cærulescens (L.).

The true home of this interesting, miniature falcon is the deep, hot valleys and at the base of the heavily forested hills. It has come under my observation at limits of from 800–1,700′, and I have not seen it at a higher elevation in the interior of the country; whilst on the outer hills it has been obtained up to 3,860′ at Mangpu, 16-2-18, as well as at 1,100′, 2-3-20 (G. E. Shaw.), and reported from the Nagri Spur at 4,000′ by Mr. E. G. Birch, and from Bloomfield at 6,000′ near the station of Darjeeling by Mr. H. P. P. Barrett. I have seen a number of specimens from the Terai. There is little doubt that it disperses over a wider area after the breeding season, notwithstanding its distribution limits are strictly confined to low elevations. Towards April they congregate in small colonies at their nesting haunts and are then partial to clusters of lofty 'simal' trees in open tracts in preference to the dense forest, when towards evening, they become very active, enlivening the air with their bold, dashing flight, which partakes of the combined actions of *Artamus* and *Cypselus*, and though they eventually settle on the naked branches at a great height from the ground, they often dash overhead within a few feet, uttering all the while a shrill whistle. At midday it is no unusual sight to observe an odd bird enjoying a siesta in the open branches of any diminutive tree by the road-side, and even in a village quite oblivious to the daily routine of its human occupants; unless one is acquainted with this habit it might be mistaken for a shrike. I have found their breeding haunts entirely deserted at other times. In one day, 28-3-17, I had the gratification of observing six birds, at scattered intervals, along one valley. My observations have reference to the years 1917 and 1920 in March between periods covering the 12th–28th.

Four ♂ ♂ examined: Bill from cere, 10–11, av. 10-4; wing 99-104, av. 100·8.

One ♀ examined: Bill from cere 11; wing 100; ovaries developed but not breeding, 28-3-17. Several filariæ taken from behind the eye of one of these specimens. I have come across them in other birds of diverse genera such as *Spilornis*, *Motacilla*, *Siphia*, &c., &c.

Soft parts: Iris brown; tarsus greenish-plumbeous.

I have refrained in this solitary instance from stating the exact locality as it would be quite within the realms of possibility for an over-zealous or selfish collector to decimate the birds at their breeding colonies to such an extent to disastrously affect their status. As the eggs are very rare, or even not known of this form in collections, no such charge can yet be brought against the brother Oologist, and he well might have a grievance against the skin collector.

492. The Bengal Green Pigeon. Crocopus phœnicoptera phœnicoptera (Lath.).

Entirely a plains-species. I found it plentiful around the village of Kumargram in East Bengal near the Assam boundary.

493. The Thick-billed Green Pigeon. Treron curvirostra nipalensis (Hodgs.).

Evidently confined to the base of the foot-hills and adjacent forested country of the plains.

494. The Pin-tailed Green Pigeon. Sphenocercus apicauda (Hodgs.).

Recorded for the Himalayas below 5,000′ or 6,000′. This pigeon only *appears* in the Rungbong Valley *in the cold weather*, and is then generally found below 4,700′ or thereabouts. Gopaldhara, 3,500′, 30-1-19. I counted twenty-six Pin-tailed Pigeons at rest on the bare branches of a tall ‘siris’ (*Albizzia stipulata*) tree at the bottom of the valley. Obtained in the Tista Valley at 2,000′. ♂ ♀ 6-3-19. (G. E. Shaw)

495. The Kokla Green Pigeon. Sphenocercus sphenura sphenura (Vig.). ‘Halisa’ Paharia.

Recorded for the Himalayas between 4,000′ and 7,000′ at which limits it is generally distributed in well-wooded tracts of the Outer Ranges during the summer. It breeds around Gopaldhara at elevations of from 3,440′–6,000′ during ‘the rains’; a few birds remaining around 5,000′–6,000′ throughout the ‘cold weather’ though the majority migrate; in what direction can only be conjectured. It is recorded to the west of Nepal in summer, but stated to remain throughout the year in Nepal and farther east which requires modifying for the Sikkim Himalaya. I have heard the delightful notes of this Green Pigeon in the station of Darjeeling, where the birds are quite at their ease amongst the trees with no likelihood of being molested. Evidently double-brooded, as young birds have been found in the nest as late as 14-9-15 when I saw two nestlings at Okayti. As soon as they arrive or shortly after their arrival at Gopaldhara, they commence calling, when on 24-5-18 between a limit of 3,500′–4,720′ I noted this to be the case. 5,000′, 16-10-14, much in evidence in the forest. 8-10-21, half-a-dozen birds congregated; on 24-10-21, apparently had deserted this same patch of forest and evidently had migrated. In evidence on 27-7-15. Specimens obtained 4,720′, 2-10-19, juvenile male, 5,800′, ♂ 23-11-20, when several pairs were in evidence feeding on a dark purple berry. 6,000′ and below. ♀ 30-1-19; ♀ 21-12-11.

The rufous of the crown, orange wash of pink on the upper breast is wanting in the young male of the year which is in similar coloration to the adult female, inclusive of the under tail-coverts; while there is an entire absence of the maroon on the back, a few feathers of the lesser wing-coverts showing this character, which is faintly indicated on the median wing-coverts. On several occasions I have seen these birds called up to within measurable distance by an almost perfect imitation of their familiar notes.

496. The Green Imperial Pigeon. Muscadivora ænea sylvatica (Tick.)

Recorded for the base of the Himalayas from Sikkim eastwards. Evidently confined to the Terai and Plains. It is entirely absent from the Rungbong Valley even as a straggler.

497. Hodgson Imperial Pigeon. Ducula insignis insignis Hodgs ‘Hukas’ Paharia.

Recorded for the Himalayas at moderate elevations, ‘about 2,000′–6,000′’. Obtained in the Tista Valley at 2,200′, ♂ 29-7-20, 2,500′, ♂ 9-7-18, elevation ? ♂ 6-8-15; 3,500′, ♀ 6-3-21. (G. E. Shaw). I observed it in small parties in the rocky, wooded ground on the precipitous right bank, in the Gorge of the Tista River at Dikchu, at an elevation of 2,800′ in March 1920. I signally failed to locate any Imperial Pigeons in the Eastsrn Dooars, in January 1922. My impression is these birds ascend in ‘the cold weather,’ as it is only at this period of the year they occur spraingly in the minor valleys on the west.

A pair was obtained in the vicinity of the Gopaldhara Bw. at 4,720′ in January 1914. I had an excellent view of a pigeon at 3,500′ on 14-11-19* which could only have been this species but the fact of its being single and showing a decided chestnut colouration, intensified by a white crown ; were this area within the distribution limits of *Alsocomus puniceus ;* this record would have been nearer the mark by a reference to this last species.

498. The Bronze-winged Dove. Chalcophaps Indica (L.).

Generally distributed at all elevations from the plains-level up to 6,000′. Equally plentiful in the valleys of the interior, where it occurs commonly in winter, as it is on the outer ranges throughout the whole year.

499. The Blue Hill-Pigeon. Columba rupestris turkestanica But.

Recorded under " specimens labelled Kashmir, Sikkim, and Darjeeling in the British Museum Collection probably came from more northern localities". During the Mount Everest Expedition, Mr. A. F. R. Wollaston found this Pigeon above 12,500′ below this elevation occured the next species.

500. The White-bellied Snow-Pigeon. Columba leuconota leuconota Vig.

Recorded for the Himalayas, 10,000′—14,000′ in summer, but descending to lower elevations in winter. The Snow-Pigeon was reported to come down on the maidan at Chungthang, 5,350′, in the interior during severe weather, which is quite feasible. The forest officer who supplied me with this information had a sound local knowledge of the birds. I met with it on the first occasion at about 6,000′ on 26-2-20, when a solitary bird was disturbed out of some growth above a huge projecting boulder along the path to Lachung ; in its flight it crossed the foaming river before a clear view was obtained, once it had taken up its fresh quarters amongst the trees ! During my stay in Lachung up to the 10th March ; it was an every-day occurrence for large parties to settle in the rough ground surrounding the village, and on the morning we left, a last impressive view was obtained of a large flock in the valley, at just about the most distant point reached by the Choughs after a fall of snow in the higher reaches. Seen at a distance, long before it is possible to distinguish the form of the birds as they move over the ground, bunched together ; one can aptly describe their rippling motion only by comparing it to that of a forthy sea lapping an open beach. Numerous Fritillaries (*Argynnis lathonia* issæa) chiefly, with a sprinkling of Swallow tails (*Papilio machaon sikhimensis*) were on the wing, and as we reached the wooded glades, a further acquaintance with the rare vivid Blue (*Herda moorei*) was in store.

On leaving Lachung my thoughts were expressive of regret in taking leave of its primitive people—nature's gentle-folk, still isolated from the turmoil of life ; and if smiling countenances heightened by rosy cheeks are any criterion of a happy disposition ; here was ample evidence that, the fewness of their wants more than compensated for any questionable advantages that are likely to accrue from the penetration of Western influences.

Dr. Hartert gives the wing measurement of this form as 233–245.

My three specimens measure : ♂ ♂ Wing 239–243 ; ♀ wing 241.

501. The Tibetan Snow-Pigeon. Columba leuconota Gradaria Hart.

This form is recorded from Gnatong in the Chumbi Valley, and there is a strong likelihood of it occurring within the frontier of Independent Sikkim. The wing measurement is given by Dr. Hartert as 239–262.

502. The Speckled Wood-Pigeon. Dendrotreron hodgsoni (Vig.).

Recorded for the Himalayas at elevations of from 10,000′-13,000′ in summer, and at 6,000′-9,000′ in winter, Obtained at Gopaldhara at 5,000′, ♀ 7-1-12, when feeding on ' Jinghana ' berries in the forest, and also at Mangpu at 5,500′, ♂ 2-4-20 (G. E. Shaw). Elwes obtained it on the Tankra La at 13,000′ in the autumn of 1870. (Blanford).

503. The Eastern Cushat. Palumbus palumbus casiotis Bp.

Reported to have been obtained on Tonglo on several occasions. Up to the present it is unknown to me. Information in respect to its status, if actually occurring in these hills, is desirable. Stuart Baker records it from the better wooded parts above Gyantse and further north. (*Indian Pigeons and Doves*).

504. The Ashy Wood-Pigeon. Alsocomus pulchricollis (Blyth).

Recorded for the Himalayas at elevations of from 7,000′–10,000′ or higher. I have seen specimens obtained on Senchal at 8,000′ during the winter (H. P. P. Barrett). It is said to have formerly frequented the station of Darjeeling in flocks of ten or thirty from November to April, and odd parties probably occur at the present day in the well-wooded portions on occasions. During the cold-season, when on the ridge above Gopaldhara at 6,000′ I saw large flights of this pigeon presumably, descending in a southerly direction, possibly under stress of weather.

Obtained by Messrs. E. O. Shebbeare and W. P. Field from the plains at Gorumara to the east of the Tista River. Recorded Ibid. Vol. XXV, page 300. (C. M. Inglis.).

505. The Indian Turtle-Dove. Streptopelia orientalis meena (Sykes).

This Dove is the *Turtur ferrago* (Eversm.) of Blanford's ' Fauna.' As there is some confusion with the forms of the *orientalis* group, both in the nomenclature and recorded distribution ; the following extracts have been collected for future information, as correctly identified specimens, from any locality and every month, from the hills in particular, are a desiderata. The nomenclature here followed is in accordance with Dr. Hartert's treatment of the group. Recorded as breeding in the Himalayas as far east as Sikkim at elevations of from 4,000′–8,000′ from May to August. Migratory in the winter throughout the whole of India as far east as Behar, from whence my specimens have come. Tirhut. (C. M. Inglis). So far, I have failed to locate this form in the Sikkim Himalaya. All the forms in the *orientalis* group differ from the *turtur* group in having the tips to the feathers of the neck patch grey, *meena* is the palest form of the three here mentioned : the throat is albescent and the belly is almost white, which last character cannot be lost sight of in life. For the purpose of discrimination between the other two forms when available for examination : vent and flanks very pale grey and under tail-coverts white. (Stuart Baker). ♂ ♀ Wing 187–202, maximum 195. (Hartert).

506. The Rufous Turtle-Dove. Streptopelia orientalis orientalis (Lath.).

Recorded from ' East Tibet to Nepal and Sikkim, at all events the northern boundary of the latter State, also from Bhamo in Upper Burma ; probably also in northern Assam as an occasional visitor '. (Hartert.) According to Stuart Baker, Nepal birds are true *orientalis* as are those from Sikkim and Tibet while Darjeeling specimens in the B. M. Coll. are mostly (*meena* = *agricola* Tick.), and recorded as resident in the extreme north. Vent, flanks and under tail-coverts pale grey. (Stuart Baker.). ♂ Wing 190–204 ; in most cases smaller in ♀ 180–198 (Hartert). ♂ 185–200, ♀ 176–195 (Witherby). Specimens obtained around Maling, near Ringim, 4,590′, in the early summer of 1920 are referable to this form, which appears to be found at all events is the interior, though the exact determination of the birds which occur on the outer ranges around Mirik, sparingly in winter at 6,000′ ; when I last observed one on the 6th of November 1921, remains doubtful, until specimens have been actually secured. In the Mai (' Khola') Valley in East Nepal all birds obtained are intermediate *orientalis* × *meena* where at an elevation of about 7,000′, a pair of breeding birds with a clutch of two eggs were taken on 2-5-12, ♂ wing 191 ; ♀, 193. In the female the under tail-coverts and the broad tips to the tail feathers on the underside are white equally ; these characters are less pronounced in the male, which remark applies to another specimen obtained from this locality on 19-4-12, wing 185 ; which agrees more with *orientails* on the upper surface and in showing less rufous and no white tips to the lesser and median wing-coverts, scapulars and tertiaries ; and while the underside approaches nearer to ' orientalis ' there is no plumbeous suffusion as is the case with a bird from Kumargram, ♀ 14-1-22, wing 182. This was certainly the typical form ; as this specimen was neither the pale *meena* nor the rich vinaceous *agricola*. It also showed more plumbeous on the forehead and crown than is the case with *agricola*. In the Eastern Dooars in January, this dove was fairly common in the open country around the villages, but did not occur in the heavily wooded tract at the base of the hills ; unfortunately I failed to make the most of my opportunities, These doves never seem to be plentiful in the hills, and I have never seen them in the well-wooded portions of the country, which was not the case with the next form in Upper Assam.

507. The Indian Rufous Turtle-Dove. Streptopelia orientalis agricola (Tick.).

Recorded for Assam, Cachar and Sylhet, the Bhotan Dooars and the Terai, south of the last form eastwards to Burma, etc. (Hartert.) It is thus recorded from the Bhotan Dooars and Stuart Baker mentions it as resident in Darjeeling. This is the form with vent, flanks and under tail-coverts dark grey. (Stuart Baker). Wing measurement between 165–191. (Hartert). Blanford did not recognize this form in the ' Fauna ' treating it as a synonym of *orientalis*. In my ' Notes on the Birds of Upper Assam ' (Ibid. vol. xxiii, No. 4, 1915, page 722), reference is made to the typical form No. 368 which requires alteration to *agricola*. It was common at the foot of the hills in N. Lakhimpur in Upper Assam, where in July 1904, I obtained two pairs of this form. While ' meena ' may extend on its descent to the plains somewhat to the east of its breeding range. It appears as if, where the birds are not actually resident, a straight descent from their breeding habitat is all that is accomplished, and the cold-weather distribution area is almost as well defined as the breeding lateral distribution, at all events in the country along the foot of the hills. This group affords an interesting illustration of the overlapping of the several geographical races and we can only expect to find typical birds at the centre of each distribution area.

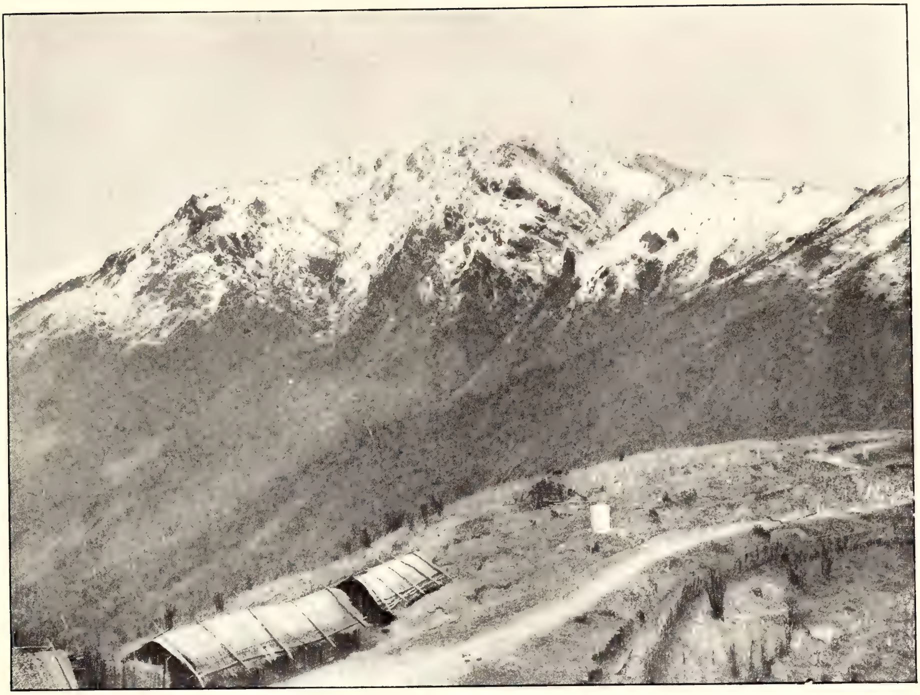
508. The Spotted Dove. Streptopelia chinensis suratensis (Gm.).

Recorded for the Himalayas up to 7,000′. This little dove arrives at Gopaldhara about the last week in March, when it immediately becomes a familiar object in the bungalow compound at 4,720′. One pair accommodates to the ramblers growing around the porch of the verandah as there is generally one nest in this situation. It breeds commonly up to an elevation of 5,500′ in the open country. The majority leave about the first week in October. First arrivals seen on 17-3-20*, but heard a few days previously. During 1921 the first birds arrived on 25-3-21*, and several departed on 16-10-21*, a pair still about on 29-10-21, whilst a straggler was in evidence 9-11-21 up to the first few days in January 1922. I anticipate the wet and cold which was experienced later on, would compel it to leave ; however, I was unable to follow this out. This late stay is most unusual, as crowds are to be seen at the foot of the hills throughout the winter, and are then everywhere obtrusive. Gammie says this Dove leaves in November in reference to its disappearance from Mangpu during ' the cold weather.' Gopaldhara, 4,720′. Whenever unmolested in the quiet hours at midday they congregate at the godown, picking up the remains of the pony food : twelve observed in a cluster on the 8th and eight on 12-6-23.*

509. The Bar-tailed Cuckoo-Dove. Macropygia tusalia tusalia (Hodgs.).

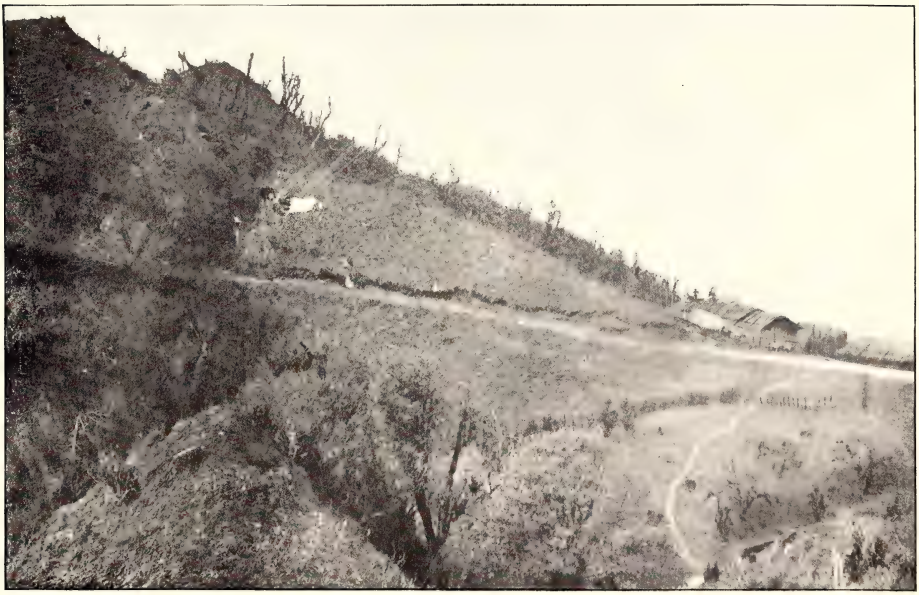
Recorded in its distribution from 3,000′ to about 10,000′. Resident and generally distributed at all elevations from 3,500′–6,000′ in the Rungbong Valley, and in the Tista Valley from 1,500′–6,000′. (G. E. Shaw). A number of birds breed in the bottoms of the valleys and they scatter over a wider area during ' the cold weather,' so that they may be found on the wooded ridges at that period of the year. It commonly occurs in the interior of Sikkim. Obtained above Dikchu at 3,000′, approx. on 22-2-20, and commonly observed around Singhik at 4,500′, 13-3-20*, when they were in parties on both occasions. Noted as plentiful in forest at Gopaldhara around an elevation of 6,000′ on 24-10-21. Obtained at 5,800′, ♂ 23-11-20 ; 5,900′, ♂ 3-1-15 ; 5,500′, ♂ 27-12-14 ; 4,000′–5,000′, ♂ ♂ 2—7-1-12 ; ♀ 30-1-16 ; 3,500′, ♂ 15-2-16, wing 189.

The deep sounding note of this dove is characteristic of the bird-life in forest at moderate elevations. The young ♂ (February) has the crown barred, the throat and abdomen barred in patches, whilst the breast and remainder of the plumage is similar to the adult. One ♂ obtained on 23-11-20 had the testes showing signs of activity. Seven adult specimens examined : 5 ♂ ♂ wing 190–219, av. 202·2. ♀ wing 188. The depth of colour on the belly and under tail-coverts is subject to variation. The barring on the tail is more pronounced in some specimens ; whilst in others, it is almost obsolete.



H. S. Photo.

SANDAKPHU FROM KALO POKHARI.
Nepal-Sikkim Frontier. May, 1912



H. S. Photo.

KALO POKHARI CAMP, 10,160′.
May, 1912.
Surroundings, the haunts of *Ægithaliscus iouschistos*, *Suthora unicolor*, *Xiphirhynchus superciliaris*, *Myzornis pyrrhoura*, *Æthopyga gouldiæ*, &c., &c.

510. The Tibetan Sand-Grouse. Syrrhaptes tibetanus Gould.

Recorded for the country north of Sikkim, strictly not within our limits, though there is every likelihood of it occurring in the snowy ranges in the extreme north. Blanford only met with it beyond the actual borders of Sikkim.

511. The Common Jungle-fowl. Gallus ferrugineus murghi. Robinson & Kloss. Records of the Indian Museum, 1920, vol. xix, pp. 13–15, 181–183.

Gallus bankiva ferrugineus Stuart Baker.

Recorded up to about 5,000′ in the Himalayas as a breeding bird, keeping much to the valleys. Commonly met with in the Tista Valley and reported as occurring up to an elevation of 5,500′, circ. above Chungthang in the interior of Sikkim. It occurs very sparingly in the Rungbong Valley up to an elevation of 4,500′ or thereabouts, yet formerly, according to local information, it was to be found at somewhat higher limits. The few birds obtained in the Rungbong Valley were shot in 'the cold weather.' I have no record of their breeding at anything approaching an elevation at which they are occasionally reported to breed. Insufficient protection, accounted for by the clearing of the forest and molestation at the nesting season are no doubt the main causes of its disappearance in many parts of the country, where it was formerly comparatively common. The Jungle-fowl delights in the warmth of the deep, hot valleys ; and provided there is a sufficiency of suitable cover such localities are ideal breeding haunts. In the foot-hills at and around 2,000′ in 1914, I heard the first bird to commence calling during the second week and again on the 21st of February at evening, when it was to be heard daily afterwards.

The Peacock, *Pavo cristatus L.* is recorded as ascending the Himalayas to about 2,000′ and locally somewhat higher. I have only seen them on the level ground at the base of the hills in the Eastern Dooars.

512. The Black-backed Kalij Pheasant. Gennæus leucomelanos melanotus (Hutton).

The distribution of this Kalij Pheasant is recorded as 1,000′–8,000′, chiefly 2,000′–6,000′, Sikkim Himalayas. Obtained as far west as the Mai 'Khola', East Nepal. Its ideal habitat is the densely overgrown, steep gullies of the hill-slopes on the Outer Ranges, where they manage to maintain a precarious existence, for their numbers are undoubtedly diminish wherever their haunts are brought into cultivation, and when they are not assured protection from molestation during the breeding season. Pine Martens account for much destruction of the eggs and young birds, and this Kalij suffers, in common with other ground game, from the depredations of these animals. They are partial to dense cover in close proximity to running water, moving out in the mornings and evenings, when feeding, to more open cover and apparently do not frequent forested land to any appreciable extent. Gopaldhara, 23-4-17. Observed to be by no means shy and fairly numerous, as I saw a cock bird on my way down, flushed out of 'the tea' by my dog ; when it took refuge in an adjacent tree, paying little attention to me as it gave vent at this annoyance to a loud scolding ; seen on my return in much the same place. 11-5-15, a single youngster in evidence. 10-6-16 remains of a female found on a secluded path with the eggs mashed in the nest. 15-8-16, a party of two adults and four youngsters seen in 'the tea.' Females are subject to marked differences in the varying depth of the coloration as a whole. Some males show a preponderance of white on the long lanceolate feathers of the breast, which appears like a patch, at the same time the upper tail-coverts have well defined white tips, which is indicated to a less extent over the whole of the back, whereas some examples have the upper tail-coverts devoid of these white markings which are only fairly indicated on the back; but most show the white shaft character on the upper back. The first-mentioned characters seem to be a sign of full maturity. Gopaldhara. Observed on two or three occasions during May and June 1923 in forest at 6,000′ circ.

Six specimens examined : ♂ ♂ wing 234–240, av. 235·5. ♀ wing 216–223.

513. The Monal. Lophophorus impejanus (Lath.).

Blanford records the zonal distribution of this Pheasant in Sikkim in summer at elevations of 10,000′–15,000′, in winter lower. Whilst Dresser states 8,000′–10,000′ in summer and as low as 4,500′ in winter. This latter records may refer to the N. W. Himalayas but is entirely inaccurate for the Sikkim Himalaya. The lowest limits reached according to my observations and where specimens have been obtained is *9,500′ during the winter* at Karponang and below Changu in the mountains of the *Interior*, when birds were often to be flushed out of the dense bamboo-growth on the rockey slopes with the ground under snow, in fact most of the birds were well above the winter snow-line. All efforts to trace it on the Singile La Ridge at elevations of from 10,000′–12,000′ during a severe winter in 1911–12 totally failed, and the Nepalis assured me its whereabouts was unknown to them. Reported by a competent observer to have been seen on Senchal, and said to have been obtained on the above-mentioned Outer Ranges ; I prefer to keep an open mind in respect to these latter statements. Around Lachung it was said to occur, but no trace of it was to be had above the snow-line, and there is little doubt that the villagers had reduced its numbers for some miles, beyond the village. It is very probable that it formerly occurred in the afore-mentioned localities even if never numerous, and its disappearance partial or complete, must be put down to persecution. Blanford found it above the level of the forest, 14,000′–15,000′ (September). Three ♀ ♀ in wing measurement are 260,267 and 282 respectively.

514. The Crimson Horned Pheasant. Tragopan satyra (L.).

This Pheasant—the 'Monal' of the Paharias, occurs on the Outer Ranges and in the Interior of Sikkim at altitudes of from *7,000′-9,000′*, *March and April*, and probably as low as *6,000′ in the Interior during the winter* and ascends to *12,000′ in the summer.* A large number of specimens collected have enabled me to fix its breeding habitat at much lower limits than *L. impejanus.* It is very restricted in its zonal distribution but widely spread wherever it has the necessary dense cover. Immature males, assuming the adult plumage, present a patchy appearance with the red and ocellated feathers distributed irregularly on the under surface. Its call resembles the syllables ' wak ' repeated several times in a loud pitched tone. Blanford never met with it below 8,000′ and bears out its lower distribution zone in comparison with L. *impejanus.* I have had specimens from the above-recorded low limits above Mangan, in the interior. Breeding commences on the Outer Ranges in late March or early April. An oviduct egg has been extracted as early as the 5th of April. Available for comparison : Twenty specimens. The wing of four immature ♂ ♂ measures from 249 (18th March)—260 (5th April), av., 257. 11 adult ♂ ♂ 265–277, av. 270·6. 4 ♀ ♀ 216–245, av. 231. My female skins thus show a decided difference in size, which seems to be the case with the females of some of the other pheasants.

515. The Blood Pheasant. Ithagenes cruentus cruentus (Hardw.).

During the winter it occurs only sparingly on the Singile La Ridge at *10,000′-12,000′*. It is plentiful in the Interior of Sikkim at similar elevations throughout the *winter* keeping well within the snow-line, yet under exceptional stress of weather it is sometimes driven down to the clear ground below; this is more likely to take place on the Outer Ranges towards the end of March, and when this event happens, the males generally announce their arrival, and if it is possible then to surround the patch of dense growth ; their stupidity gives every opportunity to secure them as they do not readily take to flight ; a female was secured alive in this way, 23-3-12. It is somewhat surprising, yet at the same time gratifying to know they exist in substantial numbers along the mountain ranges in the interior ; which is accounted for by their occupying the wilder tracts beyond the villages, as to get at their habitat entails some considerable hard toil.

The flesh is the least appetising of our game birds ; but if considered as a change of diet, when only tinned food is available, can never be entirely spurned. A number of specimens have passed through my hands from various localities in Sikkim. Fifteen specimens, 8 ♂ ♂ and 7 ♀ ♀ are available for comparison. The presence or absence of the blood splashes on the breast apparently has nothing to do with age as the smallest ♂ with a wing of 202, though minus the spurs has some crimson spots, whilst a ♂ with the maximum wing measurement 214, is devoid of any of these markings. A not quite mature ♀, with a wing of 183 shows the minimum measurement ; it had a proportion of the crest feathers, banded with fulvous, which appears to be a sign of immaturity ; after eliminating three birds which are obviously not fully mature. 6 ♂♂ measure in wing 210–214, av. 212·3. 6 ♀♀ 187–205, av. 193. The males are very variable in regard to the crimson spots on the breast which may be entirely absent or more or less indicated or heavily splashed; all show a trace of crimson on the upper black band where it meets the lower band behind the eye ; some examples have an almost complete crimson band with traces of crimson on the forehead and lores, or only on the forehead, but in a single example which is also the densest crimson-splashed on the breast, all the black feathers of the forehead and lores are fringed with crimson and, after comparison with the type, is very near to *tibetanus* of Stuart Baker. This bird was obtained along with others—showing all these variations in colour characters. The females vary slightly in the depth of the tone of the ground colour and in a few examples there is a distinct trace of crimson on the lores, under the eye and on the lower posterior portion of the band above the eye.

516. The Common or Grey Quail. Coturnix coturnix coturnix (L.).

A cold-season visitor to elevations of from 5,000′–6,000′ on their descent to the plains ; they mostly disappear as it becomes colder with the advancement of this period. Its numbers vary each year and sometimes it may be regarded as plentiful. A few birds are generally to be met with in the roughly cut ' makai ' ' baris ' around Gopaldhara. Unfortunately, very few specimens have been examined and none actually compared, so that it is uncertain whether *C. c. japonica* Temm. and Schleg. is to be also found. This Eastern Quail has been recorded on the evidence of a female skin from Bhotan. In this race ' the adult male has the sides of the head, chin, and throat dull vinous-red without black marks, the female and young male have the feathers of the throat and chin elongate and lanceolate, especially those on the sides of the throat.' (Blanford). Dr. Hartert gives the wing measurement of this form, ♂ 98–102 ; ♀ 100–106, and in the typical form, ♂ 104–115, most 108–111 ; ♀ up to 117. Behar birds are the typical form, but these probably descend to the plains by way of the North-West. *Coturnix coromandelica* (Gm.) has been reported to have been obtained in the Rummam Valley where it may possibly be resident to some extent.

517. The Common Hill-Partridge. Arborophila torqueola (Valenc.).

Recorded "commonest between 5,000′ and 8,000′ or 9,000′, occasionally found at 14,000′." This partridge is, in my experience, much *more plentiful on the Outer Ranges* than it is in the Interior, yet occurring at similar altitudes. It may possibly reach this recorded lowest limit of 5,000′ in the interior, which is however erroneous for the outer ranges, as there is no overlapping in the zonal distributions of this species and *A. rufogularis* where they meet. Neither do they move to any extent during the winter. A fine series secured in the Mai ' Khola ' in East Nepal at elevations of from *7,000′–10,000′ during March and April*, and obtained in the Lachung Valley at 8,000′, ♀ 26-2-20, one of a pair. It breeds at the end of April and in early May. Twenty-three specimens examined : 16 ♂♂ wing 144–155, av. 150·5 ; 7 ♀♀ wing 136–145, av. 142.

Soft parts : Iris brown ; bill black ; tarsus ochreous-salmon in the male, with a more decided ochreous tinge (dusky salmon-pink) in the female.

518. Blyth's Hill-Partridge. Arborophila rufogularis rufogularis (Blyth).

Recorded from the base of the hills up to 6,000′, which is substantially correct for these hills. I have no definite information of its lowest limits, but it is fairly plentiful in forest around Gopaldhara at from 5,000′–6,000′, where I have obtained many during December to February.

It appears to have a somewhat higher zonal distribution in the Tista Valley where it apparently does not come into competition with *A. torqueola*, as Mr. G. E. Shaw reports it at elevations of from 3,000′–8,400′ below and above Mangpu. This partridge is often to be heard calling before and after rain when I have known this to happen after a thunder-storm as late as the 20th of July. Towards the breeding season they commence to call in the foot-hills around 2,000′ as early as the 21st of January. The chick soon after hatching, actually gives utterance to the identical call of the adult.

Seven eggs are sometimes laid, one such clutch averages, 42×34 ; all are somewhat conoidal, and in three in the same clutch, this character is much pronounced.

Twelve specimens examined : 9 ♂ ♂ Wing 138–149, av. 143·6 ; 3 ♀ ♀ wing 133–142, av. 135·7.

519. The Red-breasted Hill-Partridge. Arborophila mandellii Hume.

Recorded for the Lower hills of Sikkim at elevations of from 1,000′–6,000′. The Tibetan Partridge PERDIX HODGSONIÆ HODGSONIÆ (Hodgs.) is recorded for the Tibetan Plateau, north of Sikkim, strictly not within our limits, but in all probability occurs at extreme elevations in Sikkim.

520. The Tibetan Snow-Cock. Tetraogallus tibetanus tibetanus Gould.

Recorded for very high tracts in Sikkim and as rarely descending below 15,000′ in summer. Blanford refers to a Captain Chamer having obtained it at Phalung near the Kangra Lama Pasa.

521. The Snow-Partridge. Lerwa lerwa (Hodgs.).

Recorded for the Himalayas from Kashmir to Bhotan and farther east at elevations of 10,000′–14,000′ in summer ; lower in winter. Reported to have been obtained formerly on the Singile La Ridge between Sandakphu and Phalut but these records require confirmation. Blanford met with it at Thangu and Yumthang. (September and early October). Not seen below 17,000′ by the Mount Everest Expedition.

522. The Himalayan Bustard-Quail. Turnix pugnax ocellatus Blyth.

Recorded for the ' Eastern Himalayas, ascends to 7,000′ '. Occurs at moderate elevations in the foot-hills and breeds around Gopaldhara during ' the rains '. Gammie mentions it as equally common from 2,000′–4,000′ breeding in May and June on the eastern side of the Darjeeling district. Gopaldhara, 28-5-23, ♀ taken with clutch of four eggs. Soft parts : Iris white ; bill pale plumbeous, culmen and tip of both mandibles horny, base of upper mandible whitish ; tarsus pale plumbeous, claws yellowish.

523. The Little Button-Quail. Turnix dussumieri (Temm.).

Recorded for the ' Lower Himalayas up to about 6,000′,' though not represented in the National Collection from the Sikkim Himalaya.

524. The Indian Button-Quail. Turnix tanki tanki Blyth.

Recorded for the ' Himalayas up to about 4,000′,' Bhutan Duars, etc.

525. The Ruddy Crake. Porzana fusca bakeri Hart.

Recorded ' Lower Himalayas, probably occurs in Sikkim.' No authentic data of its occurrence in these hills are known to me.

526. Elwes's Crake. Porzana bicolor Walden.

When I was in camp at Kalo Pokhari, 10,160′, on the Nepal-Sikkim Frontier, 22-5-12, two ♂ ♂ and one ♀ were brought in by some Paharias, who said they had been captured at an extreme height between 12,000′ and 13,000′. I did not place full reliance on their word, as the tarn or ' pokhari ' where they were likely to have been obtained was probably not at this extreme height, but might well have been a long distance from my camp in Nepal ; these birds were taken alive. Obtained below Nagri, 4,250′ circ. in the Rungbong Valley, ♀ 27-3-18 (F. S. Boileau) ; an oviduct egg was extracted from this bird. Four specimens examined : ♂ Wing 113–116 ; ♀ wing 110–117.

Soft parts : Iris crimson ; orbits, venetian red ; bill, sap-green, dusky grey at tip with a tinge of venetian-red at the base of both mandibles, inside gape slaty colour ; tarsus dull lobster or venetian-red, dusky at front ; claws, horny.

527. The Eastern Moorhen. Gallinula chloropus parvifrons Blyth.

Certain to occur at plains-levels, which remark also applies to the following.

528. The Purple Moorhen. Poryphyrio poliocephalus poliocepahlus (Lath.).

529. The Red-wattled Lapwing. Sarcogrammus indicus indicus (Bodd.).

Obtained by Mr. G. E. Shaw at an elevation of 500′ at the foot of the hills.

530. The Indian Spur-winged Plover. Hoplopterus ventralis (Wagl.).

This Plover occurs at low elevations along the Tista River.

531. The White-tailed Lapwing. Chetusia leucura. (Licht.).

Recorded for Sikkim. Unknown to me.

532. The Eastern Golden Plover. Pluvialis dominicus fulvus. (Gm.).

I have seen this Plover in open country at the foot of the hills, Sukna, 28-2-15*, observed a party of twelve to twenty settle on the east side of the Railway line. Some of the Ringed-plover (*Charadius*) are certain to occur in the bed of the Tista River and possibly also in the minor rivers.

After making a further examination of my Assam material, which is now available for comparison; there can be little doubt that two forms of this genus breed at all events in the river-beds at the base of the hills on North Lakhimpur, Upper Assam, though probably, only sparingly, and the eggs yet remain to be discovered. I have recorded obtaining *placidus* in July, ♂ 7-7-04 and two ♂ ♂ obtained on 7-1-11 are in breeding plumage with the testes well advanced in development. These specimens were secured in the bed of the Dejoo River where there was ample scope and suitable gravelly stretches of ground for nidification in 'the cold weather'. The other bird is evidently *jerdoni* with a wing measurement far in deficit of the true cold-weather migrant: a ♂ obtained on the Subansiri at Hessamara, 31-12-05, wing 103, is in full breeding plumage; whilst another example obtained on the Runganuddi, ♂ 6-5-04, wing 100, is in similar plumage, but showing signs of moult. Three specimens obtained at Gogaldhubi bhil, ♀ 8-12-05, wing 115; ♀ 11-12-05, wing 116; ♂ 18-12-05, wing 114, are in winter plumage and are evidently the typical form *dubius* to which I refer a ♀ obtained on the Dibru River at Rungagora on 15-4-03, wing 107·5; though this example has assumed the summer plumage with the exception of the black ear-coverts. I am confident that a systematic search from January to March will eventually prove my surmise to be correct in respect to these breeding birds. The fact that Ringed-plover occur at the same period of the year in both summer and winter plumage, if not remarkable, is of interest. The winter migrants appear to frequent the soft, muddy ground around the 'bhils' in company with other numerous non-resident waders and not the sandy beds of the rivers, then occupied by the breeding race.

533. The Green Sandpiper. Tringa ochropus. (L.).

This sandpiper commonly occurs in all hill rivers at low elevations. Others of this genus are certain to be found if sought for.

534. The Ibis-bill. Ibidorhyncha struthersii Vig.

Recorded by Blanford from the interier of Sikkim at 12,000′ at Yematong (Yumthang) in September. It has been obtained during 'the cold weather' in the Tista and Great Rangit River beds. I saw it frequently on the Raidak River in January, in small parties. It evidently *occurs on all the rivers of the Eastern Himalayas at the foot of the hills in the winter.*

535. The Woodcock. Scolopax rusticola rusticola L. 'Simkukra' Paharia.

The Woodcock is widely distributed at moderate elevations in the cold-season, though they apparently do not extend into the plains, as was the case in Upper Assam. In the Rungbong Valley it does not appear to be as plentiful as formerly. It is partial to strips of ground under cardamom cultivation along the 'kholas', when the soft soil at the edge of the running water, wherever these birds have taken up their quarters, is pitted with probings. They arrive at Gopaldhara in late September or early October, 3,500′, 30-10-14*. One noted at evening flying south, evidently intent on settling, and another observed the next day during the evening. A pair were often to be seen at Lachung, 8,800′, in early March 1920, in the bed of a small water course overgrown with scrub vegetation, during the frosty days; at early morning they came out more into the open.

536. The Wood-Snipe. Capella nemoricola (Hodgs.).

The generic name *Gallinago* is discarded for the earlier name *Capella* of Frenzel which takes precedence over the former.

Recorded as breeding at 7,000′–12,000′ in the Himalayas. A few are obtained in the Rungbong Valley nearly every ‘ cold weather.’ Previous to the draining of the ‘ pokhari’ at Mirik, this locality must have been a sanctuary for numerous Warblers, Rails and Snipe. Mr. G. E. Shaw has obtained it at Mangpu 3,5C0′–400′.

537. The Pintail Snipe. Capella stenura (Bp.).

This Snipe occurs at moderate elevations, though I anticipate the majority of the birds descend to lower limits which is apparently the case also with the Fantail Snipe.

538. The Himalayan Solitary Snipe. Capella solitaria (Hodgs.).

Very few specimens are shot of this rare Snipe. I observed a pair on Tonglo at 10,000′, a short distance below the summit level on the Nepal side of the Frontier in the bed of a mountain stream in January 1912. I am indebted to Mr. A. J. H. Tietkins for a ♀ which he obtained at Tukdah on the 14-11-21. wing, 160. Iris hazel; tarsus pale yellowish-olivaceous. This snipe is recorded at 9,000′–15,000′ or higher at the breeding season. Inglis obtained a ♂ in the Rungbong ‘ jhora ’ at Sukna, 9-12-19.

539. The Indian Shag. Pahalacrocorax fuscicollis Steph.

This is evidently the cormorant or Shag which commonly occurs on all the large rivers ; it has been frequently observed on the Tista River. On the Raidak River observations pointed to this species. Probably the Large Cormorant occurs, but no specimens have been obtained to settle this point beyond doubt.

540. The Great White-bellied Heron. Ardea insignis Hodgs.

Observed on a few occasions on the Tista River below Birik, when it kept well over to the uninhabited left bank, with little chance of molestation.

541. The Cattle Egret. Bubulcus ibis coromandus (Bodd.).

Commonly occurs at low elevations.

542. The Little Green Heron. Butorides striatus javanicus (Horsf.).

This species frequents the Rungbong River up to at least 3,600′ and possibly right up to the head of the valley. Obtained below Turzum on 15-2-20 (O. Lindgren), and Mr. G. E. Shaw has also secured it in the Tista Valley at an elevation of 1,400′.

543. The Barred-headed Goose. Anser indicus (Lath.).

This goose has occurred in the Rammam River, from whence Mr. H. P. P. Barrett has shown me a specimen obtained out of a small party in ‘ the cold weather.’ The following records refer to unidentified geese on the upward migration : Sandakpu, 11,929′, summit level, Nepal-Sikkim Frontier 2-3-12. Fourteen geese passed overhead going north ; on reaching the summit, they paused in their flight after an apparent momentary impulse ; as they quickly assumed their accustomed V formation and again headed north. At their oncoming I was located below a spur on the wind-ward side of the mountain ; and thus was unable to follow their movements, after they passed my field of vision. 7-3-12. From sixty to seventy geese passed overhead at an immense altitude cackling at the time. On reaching the summit they dispersed into three parties, of which, the two outer gaggles were much the more numerous, probably to unite again once the direction was decided upon, though I could not follow out this conclusion. They were heading north, in the same direction generally as the previous lot, which would take them over the ‘ Everlasting Snows.’ Every appearance of hot weather in the plains yet on 15-4-12, the worst snow-storm during this winter was experienced, which lasted for several days.

Jalpaiguri (Plains of N. Bengal), 27-2-15*. Two huge migrations of geese occurred this morning heading north in a leisurely manner ; the second congregation consisted of several V shaped companies which appeared to intersect each other at many points as to cause an apparent break in their formation, but on careful observation this proved not to be the case ; the white plumage was enhanced at certain strokes of the wing in the strong light.

Gopaldhara, 4,720′, 11-4-16, 10 a.m. Geese estimated between three and four hundred leisurely wending their flight in a northerly direction ; another lot passed over at evening 7 p.m.

12-4-16, 10 a.m. On this occasion I estimated about one hundred geese to pass overhead, going north.

544. The Ruddy Sheldrake. Casarca ferruginea (Pall.).

Kalo Pokhari, 10,160′, Nepal-Sikkim Frontier, 28-3-12. A pair of Brahminy Duck passed over Sandakpu this morning, heavy north-west and north-east gales accompanied with falls of snow the following two days. 1-4-12. This afternoon during a heavy, dense mist I heard these birds in evident distress at their inability to find their bearings ; they failed to negotiate the ridge, as their cries became fainter as they retreated down the valley. They migrate in pairs and keep in close company at all times. Blanford records a pair on the lake Bidan near the Jelep-la in the Cho La Range when one was shot by Elwes (August).

545. The Gadwall. Anas strepera L.

The Gadwall is to be found on occasions in small parties on the large rivers before the upward migration commences.

546. The Wigeon. Anas penelope L.

Obtained on the upward migration in the Lachung River on 8-3-20, ♀ during a bad spell of weather, when the birds were forced to seek shelter in the river-bed at an elevation of 8,700′.

Soft parts : ♀ Iris brown ; tarsus greenish-plumbeous ; bill slaty-blue, nail, black, terminal portion.

547. The Pintail. Anas acuta acuta L.

Two ♂ ♂ obtained on 8-3-20 in the bed of the Lachung River on the same occasion as the previous records were obtained out of a small party. One bird was ‘ rolling in fat ’, but the stomach only contained small seeds. There had been a heavy snow-storm at this time.

548. The Eastern Goosander. Mergus merganser orientalis Gould.

Recorded, ‘ summer in pairs at 10,000′ and upwards on the Himalayas.’ They commonly occur at the foot of the hills on all fair-sized rivers and may be seen for a long way up the Tista River. When in the Gorges they almost clip the water in flight, while on their return at evening, to the more open water in the plains they fly at a considerable height and with rapidity, generally in a well-separated cluster and it requires accurate shooting to bring a bird down. Unless it can be put to some useful purpose ; there is no object served in such a wanton act, as this handsome Duck is every bit a part of the attractions which go to complete many an entrancing picture of wild-life. On numerous occasions have I watched them busy at work diving in the clear, flowing water or resting contentedly at mid-day, allowing the current to carry them on its course. While it is no unusual sight to see a group sunning themselves in shallow water, when every now and then, they assume an erect position with much beating of the wings.

549. The Indian Little Grebe. Podiceps ruficollies capensis Salvad.

It is generally conceded that the Grebe which Mandelli obtained in Sikkim and described by Blanford as *P. albescens* is an albino ; which record probably refers to this species.

Note.—A number of additional records have been inserted since the compilation of this paper bringing it up to date 31st August, 1923.

H. S.

REVIEWS

THE PROTECTION OF BIRDS. AN INDICTMENT by Lewis R. W. Loyd (Longmans. London 1924).

We have received a little book with the above title from the pen of Mr. L. R. W. Loyd. It appears to be a piece of propagandist literature with reference to the Wild Birds Protection Act of 1923 sponsored by Lord Grey; and to have been written more immediately in response to a book by Miss Linda Gardiner entitled *Rare, Vanishing and lost British Birds.* This latter work has been sponsored by the Royal Society for the Protection of Birds.

We may start by saying that both Mr. Loyd and the Society have the same object at heart; they both desire to protect the Avifauna of the United Kingdom. Where they differ is over the methods of attaining their end.

Mr. Loyd's charge is that the affairs of the Society are managed by people who, with all other qualifications for the work, fail in one essential particular, that they are not experienced ornithologists. As a result of this he believes that they are working on wrong lines; that the protection which they advocate and help to establish is based on sentiment rather than commonsense, and that the result of it is to protect species which need no protection at the expense of scarcer and more interesting forms. In support of this belief he adduces a number of interesting examples and evidences.

We do not wish to enter into the controversy on one side or the other; all we should like to remark is that in this and similar controversies there is seldom any sharply defined path of right or wrong Mr. Loyd has however undoubtedly marshalled a selection of facts which are worthy of consideration and we hope that the Society will at least thoroughly examine the point of view for which Mr. Loyd stands. For behind him directly and indirectly is ranged a large body of collectors and scientific ornithologists who are entitled to be heard in the matter, and whose opinions the Society cannot afford to flout in their entirety without incurring a charge of levity and prejudice in the conduct of its trust.

There is a grave tendency on the part of a large proportion of the supporters of the Society to regard scientific naturalists and collectors with horror and to treat them as the professed enemies of all bird life; and this attitude in many cases has undoubtedly destroyed the fairness and impartiality of judgement which are ever an aid to the true realization of all worthy aims.

The name of Science in the past has frequently been blackened by the acts of unworthy votaries and hangers on. It is too much to hope that it will never again be smirched in the future. But many of the truest friends and preservers of the British avifauna have been found in the ranks of Science and not in the membership of the Royal Society for the Protection of Birds.

Tremendous changes are occurring in the face of the British Isles; the advent of the motor and the great arterial roads and the consequent opening up of vast tracts of country to the builder and the small holder form a danger to our native avifauna greater than it has ever had to meet before. Our plea therefore to both sides in this controversy is to join forces and fight shoulder to shoulder for their common aim: to this end certain prejudices may have to be sacrificed and certain concessions made; but the danger is pressing and let all men look to the end rather than dispute about the best means.

H. W.

'A MONOGRAPH OF THE BIRDS OF PREY'. PART I. By H. KIRKE SWANN, F.Z.S., M.B.O.U. (Wheldon and Wesley, Ltd.) Price 26*s*. net.

We welcome Part 1 of Mr. Kirke Swann's *A Monograph of the Birds of Prey* with its three beautiful coloured plates of Vultures, one of eggs and a photogravure plate depicting a Griffon Vulture's nest and young. The coloured plates are all by H. Gronvold, with whose work most bird lovers are familiar and who needs no introduction in these pages.

The monograph is to see the light of day in twelve parts and if the remaining eleven are up to the standard of this first part ornithologists, the world over, will have nothing to complain of.

In his introduction the author informs us that he has divided the diurnal Birds of Prey of the Order ACCIPITRES, into four families comprising 100 genera, including 322 species which, with their sub-divisions, comprise 692 forms. Part 1 deals only with 28 forms of vultures of which 17 belong to the Old World and 11 to the New and on pp. v and vi of the Introduction will be found a most useful table giving, at a glance, the world distribution of every genus, thus :—

Genera	Forms	Palaearctic	Nearctic	African	Indian	Indo-Malayan	Australian	Polynesian	Neotropical
FAM. CATHARTIDÆ—									
1. Vultur ...	1	...	...	...	...	...	...	...	1
2. Sarcorhamphus..	1	...	...	...	...	...	...	...	1
3. Coragyps ...	2	...	...	...	...	...	...	...	1
etc.	etc.								

The author states that he has altered the boundaries of some of these zoogeographical regions 'for the sake of convenience in classifying the forms,' but as he defines each region carefully the alterations make but little difference.

The 692 forms dealt with are represented very unevenly throughout the above regions. We find 110 are Palaearctic, 63 Nearctic, 138 African, 52 Indian, 93 Indo-Malayan, 44 Australian, 22 Polynesian and 170 Neotropical. This, of course, does not mean that the forms of one region do not find their way over into those adjoining and we, in India, have to thank the Palaearctic regions for a good many of our winter migrants.

Mr. Kirke Swann gives us four very interesting pages on the ancient sport of kings—'Falconry and Hawking,' and, as he says, 'no monograph of the Accipitres could be considered complete unless it dealt with this fascinating subject.' He traces the art of falconry back to 1700 B.C. in Persia, and tells us that it probably existed in China even before that.

We are told that the 'Boke of St. Albans' (1486) enumerates the falcons and hawks then in use, with the classes of society they were proper to ' and it is interesting to note that the eagle had pride of place as being 'proper to ' an Emperor and the gyrfalcon and its tiercel to the King, and thus down a long list to the priest who had to be content with a sparrow-hawk and the holy-water clerk with the humble, muskayte, or male sparrow-hawk !

What we, however, do not quite follow is the author's assertion that a falcon will not 'bind' to its quarry after striking it in the air and nor does it sirike it on the ground. We quote the passage referred to :—'The true falcons, it should be noted, kill their quarry with a terrific blow of the half closed "fist" after dropping on it from above in one of those magnificent stoops that always thrill the observer, whether performed by the wild falcon or the reclaimed bird. The flight generally commences by the quarry, well aware of the power of its terrible adversary, endeavouring to escape its fate by wildly soaring up and up, while the falcon, circling always, rises until it obtains a favourable position above its quarry before making the fatal stoop. If the first blow is not effective the falcon will follow its victim down and strike again, *but it does not "bind" to it, nor does it strike it on the ground.*' (The italics are ours.)

Many readers of the B. N. H. Society's Journal will not be inclined to agree with this statement. How often have we seen a saker 'bind' to a kite in mid-air, after a bout of stooping ; or a peregrine bring down a heron firmly bound to the latter's wing. Again, how often have we seen an houbara, pirouetting beside a friendly bush, with wings drooping to the ground and tail spread, fan-like, over his back, ready to show fight sent staggering by a stooping falcon, showing that falcons both bind to their quarry in the air and also strike it on the ground.

We are entirely in agreement with the author when he says 'I disagree entirely with the present attempt to split up such genera as *Spizaëtus* so that practically every species forms a separate genus. We have such splitters on the one hand, while on the other we have conservative ornithologists like Dr. Hartert, who would unite both *Astur* and *Accipier* in one huge unwieldy genus.'

Considering, as the author points out, that such groups contain about one-fifth of the hawks of the world, to unite them under one genus is asking for 'deplorable confusion' and so long as we have good characters such as the difference in the middle toe, in these two genera, why not keep them apart.

So far as this Part I of the monograph is concerned, we who are chiefly interested in the avifauna of India might consider ourselves somewhat shabbily treated, even though we get a very good share of the world's vultures. Six Indian forms are dealt with which are included in the Family ÆGYPIIDÆ the Old World Vultures. These are :—

1. *Ægypius monachus* better known to us as *Vultur monachus* (Fauna of Br. India.)
2. *Gyps fulvus fulvescens* ,, to ,, *Gyps fulvus*.
3. *Gyps himalayensis*.
4. *Gyps indicus*.
5. *Gyps indicus tenuirostris* ,, ,, ,, *G. tenuirostris*.
6. *Pseudogyps bengalensis*
7. *Sarcogyps calvus* ,, ,, ,, *Otogyps calvus*

The author quotes extensively from previous publications and, in so far as the Indian forms are concerned, Hume and Mr. Stuart-Baker are his chief authorities. It is not possible that in a work of this nature, every reader will see eye to eye with the author or the descriptions he has quoted from other authors, but this is a negligible atom when we consider the excellence and magnitude of the work as a whole. For instance, when dealing with the Indian White-backed Vulture *Pseudogyps bengalensis* the author quotes from Mr. Jesse (*Ibid.*, 1903, p. 66) as saying 'it is common and permanent in the Lucknow District and when too high in the air for its white "waistcoat" to be seen can be distinguished from *Sarcogyps calvus* by the more pointed pinions of the latter.' This is rather misleading, and one would infer from it that the under wing of the Indian White-Backed Vulture was black, as in the Pondicherry Vulture, but this is by no means the case. There can be no possible confusion between the adults of the two species at any height. In *Sarcogyps calvus* the under parts are black, except for the white crop and thigh patches, whereas in *P. bengalensis* one gets the impression of a bird that is *almost* half white and half black. The entire body and tail will appear black and the wings half white and half black.

Moreover we are told that this bird does not range high in the Himalayas as it is not a mountain bird, and yet it is now pretty common in most of our hill stations such as Simla and Murree.

Similarly, the author informs us that the Pondicherry Vulture, (*Sarcogyps calvus*), 'is widely distributed in India but is nowhere very abundant. It occurs in the lower Himalayas, but is rare in the Punjab and Sind.'

We can hardly consider this vulture *rare* in the Punjab as one can seldom see a flock of vultures anywhere without seeing one or two of this species among them, though they are more often seen alone or in pairs.

We have seen them as high up as 9,000 ft. in the Himalayas.

We cordially recommend this part of the monograph, with its beautiful illustrations, to our members and meanwhile will await the appearance of its successors with a pleasurable anticipation of joys to come.

C. H. D.

NATURE AT THE DESERT'S EDGE. (Studies and observations in the Bagdad Oasis). By R. W. G. HINGSTON, M. C., M. B., I.M.S. H. F. & G. Witherby, 326 High Holborn, W. C., 1925, 299 pages, 11 plates. Price, 15/ shillings net.

This exceedingly interesting book is the latest of the series of natural history volumes which have made their author so popular among students of insect life. The book begins with a brief note regarding the physical features of Iraq and life in an oasis in the desert, which was the venue of the activities so carefully studied and so beautifully pictured. The main theme of this volume is the study of the senses, instincts and behaviour of insects, spiders and other related animals. The first portion deals with the wasps of which the author has selected four examples : *Ampulex assimilis*, Kohl., *Psammochares melas*, Ki., *P. rutilus* and *Cryptocheilus rubellus*, Er. The habits of these ' hunter ' wasps as the author designates them, their pursuit of prey, combat, capture and stinging have been described in a most vivid manner. Simple experiments which were introduced to test author's theories of behaviour add still further to the interest of the subject. The most impressive features of the lives of these tiny creatures are :—' A solitary toil, a persistency of effort, a glowing enthusiasm and a deadly skill.'

From the wonders of the armour and skill of the ' hunters ' the author goes on to describe the wonders of the defence of the ' hunted.' The life-histories and habits of the caterpillars of *Dicranura vinula*, L., *Taragama siva*, Lep. and *Deilephila nerii*, all members of the Order Lepidoptera, are described and structural details added.

The author has made a special study of concealing coloration, alarming attitude and warning markings, sudden jerky frightening movements, display of hidden structure, and finally the most effective of all weapons the corrosive liquid, as means of concealment and defence.

From the ' hunter ' the author passes on to the ' stranglers' who use their nets to capture the prey and wind ropes of silk to strangle it and poison it when he is properly secured. These are the spiders. Here again, the author expounds his theory of perfect concealment of these spiders to catch their prey unawares.

The next two chapters are devoted to the Solifugids and their habits and an exciting description is given of the warfare of a Solifugid with a Scorpion.

The book is brought to a close with an account of a locust swarm.

All through the book the author has endeavoured to prove the perfection of various adaptations met with in the wasps which have to catch their prey and paralyse it, and caterpillars which have to defend themselves against attacks, particularly of birds and parasitic insects and in places his vivid descriptions make his arguments very convincing. While describing the defensive mechanism of the Puss moth caterpillar he says ' up go the tails the long telescopes protrude, the scarlet filaments curl and quiver ' and finally the corrosive liquid is squirted. Certainly a very convincing account of the efficacy of the defensive organs. The warning attitude, armour of long setæ and sudden display of hidden structure, etc., are, according to the author, the means of frightening away birds and the insect parasites. Man looks at every thing from his own point of view and it is doubtful how far this anthropomorphic explanation is the correct interpretation of actual facts. It is highly problematic if toads, and frogs, lizards and birds get frightened by such behaviour. And we are not certain if insect parasites search their prey with their sense of vision. It is very likely that the visit of a tiny Chalcid parasite is not even noticed till the deed has been accomplished. Further it remains to be proved whether the worst enemies of insects are not protozoa and bacteria and fungi, rather than other insects and bigger animals.

All arguments of adaptations are based on the fundamental conception of the utility of everything produced by Nature. The author has on every occasion argued to prove the wonderful perfection of structural adaptations and intelligence of insects and spiders, and even the Solifugid has got his share of praise. It is here that one would differ from the author. No praise is sufficient for the skill of the hunter or the war tactics of the spider or the solifugid but does all this show intelligence of a high degree. Just as one could place the gaudiest of animals in surroundings where it will be perfectly concealed, similarly one could read intelligence in the working of the ' meanest ' of animals. Yet the author himself while describing the march of the locust says : ' What an excellent example of instinct of direction. How blind in its relentless, its undeviating course. Better self-destruction than instinctive deviation. For nothing must check the all powerful impulse. . . . The living machine must fulfil its purpose though annihilation lies ahead.' Is not this then the true explanation of the behaviour of animals whatever their position in the scale of evolution ? Are not the wasps, the caterpillars, the spiders all living machines though perhaps little more complicated than the locust ?

The wonderful attraction which the beauty of Nature has for the author is depicted in the last page of the book, and the last sentence is truly representative of the spirit dominating all his ideas. 'We perceive at last her infinite domain, her infinite wonder, her infinite beauty, her infinite work, her infinite power.' The description of the working of Nature would have been complete if the author had added 'her infinite horrors, her infinite disharmonies and her infinite absurdities' for Nature has these in quite as great an abundance as the attributes mentioned by the author.

The book is exceedingly entertaining and written in a lucid and captivating style, scientific details have been described in a non-technical language without sacrificing accuracy.

It should be in the hands of every naturalist young or old.

M. A. H.

FAMILIAR FLOWERING TREES IN INDIA by Ida Colthrust (Thacker, Spink & Co., Calcutta. Price Rs. 1-6-0.)

This useful little volume will be warmly welcomed by all lovers of nature. The need of such a useful book was greatly felt by the wayfarer and it is well supplied by the authoress. There are many whose vocations in life do not permit them to indulge, as much as they would like to an intimate knowledge of trees, and it is for these in particular that this book has been written and illustrated.

The object of this volume is to enable us to name our common trees on sight without much labour in hunting for them in learned text-books. A popular subject has been treated in popular language and in a popular style. All the most common flowering trees are lucidly described and the reader is provided with a succinct key which enables him to name the more familiar plants he sees. One very useful feature of the book are the beautiful illustrations which are so very essential and helpful. The illustrations are not only happy but also very accurate and they give a very vivid picture of the trees under description.

The value of the book is further enhanced by the vernacular names of the trees.

The book does not pretend to treat the subject exhaustively, neither are all the flowering trees described, as the authoress confesses in the Preface, but in spite of its size it goes a great way to relieve the embarrassed wayfarer who meets with flowering trees on his way.

We recommend this useful little volume to all lovers of Nature.

D. P. F.

OBITUARIES

PROFESSOR H. MAXWELL LEFROY

The recent death of Professor Harold Maxwell Lefroy, Professor of Entomology at the Imperial College of Science and Technology, London, marks the passing of a distinguished Economic Entomologist and investigator. The tragic circumstances under which he met his death places him amongst the ranks of those men who have given their lives in the cause of science, for it will be remembered that Professor Lefroy was overcome by gas fumes while experimenting in his laboratory at the Imperial College.

During the years of his service in India as Imperial Entomologist, 1907 to 1912, Lefroy served on the Managing Committee of this Society and was a frequent contributor to the pages of its Journal in which he published several notes on the life histories of Indian Insects, particularly on those of economic importance.

We publish below an extract from an obituary notice which appeared in the *Times* :—

Harold Maxwell Lefroy was born on January 20, 1877, the son of a country squire, at Itchel Manor, Crondall, Hants. He was sent to Marlborough College, and went up to King's College, Cambridge, graduating with first-class honours in the natural science tripos in 1898. He had collected insects as a boy, and at Cambridge specialized in entomology. In 1899 he was appointed Entomologist to the Imperial Department of Agriculture for the West Indies, a post which he held until his appointment as Imperial Entomologist for India. When in 1912 the Imperial College of Science and Technology at South Kensington decided that the training of entomologist, for work in the Empire should form an important part of its functions, Lefroy was called to the new chair from India, as his experience in the tropics, scientific knowledge and enthusiasm, and great success in dealing with the administrative and practical sides of insect-pest problems were pre-eminent. Although his professorial duties had to yield to special war problems, Lefroy showed as much energy and ability in creating a school as in administrative work, and entomologists trained by him at South Kensington soon began to fill important posts in every part of the Empire.

Lefroy's method was to study the life-history of insects of economic importance in the field, as he believed that there could be found some weak link in the chain, some phase in the insect's life, in which it could be most easily attacked if it were noxious, or encouraged if it were useful. He followed this up by translating the methods he devised from a state in which they could be applied only by highly skilled persons to a form suitable for mass application. He showed great ingenuity in adapting elaborate methods for large-scale use and in devising regulations for their employment. The silk and cotton industries owe much to him, and his advice on the destruction of the insect enemies of tropical agriculture generally has been of great service. His results were published in the *West Indian Bulletin*, the *Agricultural Journal of India*, in many official papers, and in three important books—*Indian Insect Pests* (1906) ; *Indian Insect Life* (1910) ; and *Manual of Entomology* (1923).

When the war came Lefroy was one of the first to appreciate the great danger to armies in the field and to people at home from the house-fly. He was honorary curator of the Insect House at the Zoological Gardens in London, and with the concurrence of the Council devoted time and energy to a campaign againat these pests of humanity. He conducted experiments into modes of destroying them or preventing them from breeding, arranged an exhibition to impress the public with the dangers arising from them and the modes of dealing with them, and used his great powers as a convincing lecturer in teaching sanitary officials, doctors, and Army officers. In 1916 he was attached, with the temporary rank of Lieutenant-Colonel, to the Field Force in Mesopotamia with the specific duty of conducting sanitary measures against flies. He was recalled to London to deal with an equally important problem, the destruction of vast stores of wheat awaiting shipment to this country in

Australia, the agent being several species of small beetles. A committee of the Royal Society propounded several solutions effective on the laboratory scale, but impracticable on the scale required. Lefroy, on behalf of the Royal Commission on Wheat Supplies, after a rapid survey of the problem in this country hurried to the United States and there inspected the existing methods of cleaning wheat on a large scale. He then went on to Australia and in a few weeks discovered how the mountainous piles of sacks became infected, devised simple methods of preventing this, and also designed an improved and rapid way of removing a very large percentage of the beetles from wheat already infected. When this task had been accomplished he returned to England and resumed his work of teaching and investigation at the Imperial College. The next problem to which he gave attention was the ravages of the Death-Watch beetle in the timbers of old buildings. He studied the question first in connexion with the roof of Westminster Hall and soon devised an effective method. Thereafter he was consulted by the guardians of many famous buildings and old churches in this country.

There were three forms of attack on insect pests in which Lefroy specialized. He believed that it was often possible to encourage the natural insect enemies of insects, and some of his most interesting work was the result of observation in the field of what species of insects preyed on others and how these benefactors could be transferred to areas in which their services were required. He had made many observations on the fashion in which insects were lured by specific scents, sometimes not appreciable by the human nose and he conducted a large series of investigations into appropriate baits by which noxious insects might be lured to their destruction. But his favourite method was the employment of suitable chemical poisons, and his investigation of these led him deep into purely chemical work. His private laboratory at the Imperial College, accordingly, was usually extremely un-pleasant and often dangerous. But Lefroy had no thought of personal discomfort or risk when he was hot in pursuit of an idea and more than once nearly succumbed to the gases with which he was experimenting.

PROFESSOR F. HALLBERG

On November 2nd last, Mr. F. Hallberg died in the Medical College Hospital, Calcutta. He was a Swede by birth, did a brilliant course in Mathematics and Physics at Upsala University, taught Mathematics in St. Xavier's College from 1915 till 1922, was examiner in Mathematics for the M. A. & M.Sc. during that period, and published original work in Geometry. Mr. Hallberg was a singularly gifted nature. His mind felt at home in the most abstruse speculations, he took delight in philosophical discussion, and read widely. Though Mathematics was his speciality, he was far too many-sided to feel satisfied with one discipline. Before coming out to India he was for two years Observator at the Meteorological and Seismologic Station at Vassijanre, Lappland, and after that, extraordinary Amanuensis at the Meteorological Observatory at Upsala. As soon as he had joined St. Xavier's College, he seized the opportunity of taking up Botany : all his spare time was spent in the Botanical Laboratory, his holidays were given to collecting. A large number of original papers were published, the joint work of Fr. Blatter and Mr. Hallberg. So distinguished did he become, that he was selected to make a Botanical Survey of Kashmir ; that was work which appealed to his venturesome spirit.

To be alone in the heart of wildest nature, to tramp untrodden lands, to discover hidden things, to face difficulties and hardships, to live untrammelled by convention was his delight ; one of his dreams was to join the Mt. Everest expedition. He may almost be called reckless of his life and health. When in the first ecstacy of motor-biking, speed became a passion. He had a serious accident which nearly crippled him for life, but scarcely had he dropped crutches and was able just to hop along, when he got a side-car, nothing undaunted by the awful sufferings he had so lately gone through.

In 1923 he went to Europe to study the Santonin question. On his return in January 1924 he went to Kashmir in search of the anthelmintic plant which yields Santonin. He was working as scientific adviser to the 'Indian Santonin Syndicate.' But his health had been undermined by strain, and an operation undergone in Calcutta could not save him. He died an untimely death. His breezy, cheerful character, his refinement and accomplishments, his wonderful and varied experiences, his depth and range of knowledge, his sociableness made him a fascinating companion. That so many gifts and talents were not more husbanded, not granted a chance of reaching their full measure, fills all friends of Mr. Hallberg with the keenest regret.

In a letter to Fr. Blatter, Dr. C. C. Calder, Director of the Botanical Survey of India, wrote : 'I am very sad at Hallberg's death. He was an upright man with very much that was loveable.'—

MR. L. J. SEDGWICK, I.C.S.

All who knew Mr. L. J. Sedgwick of the Indian Civil Service must have been grieved to learn that he died on the 27th June in Bombay. The *Times of India* brought the following notice on the 30th of June :

'The sudden death of Mr. L. J. Sedgwick, who was a particularly brilliant member of the I.C.S., will be widely regretted. As far as we are ourselves concerned, this means a great loss to our weekly books page. Mr. Sedgwick made a hobby of reviewing books for us, and his reviews were always of the same high standard. Though he was a Classics man at Cambridge and had afterwards become proficient in Sanskrit, Gujarati, Marathi and Kanarese, Mr. Sedgwick never spoke about these achievements, but preferred to review books dealing with scientific subjects, particularly botany, of which he had an accurate knowledge. In his reviews Mr. Sedgwick took great care to avoid any parade of learning and to write something that would be interesting to everybody, but nobody ever convicted him of a misstatement or even a rash expression of opinion. If he had lived he would, no doubt, have written other books besides the Bombay Census Report of 1921.'

His work was equally appreciated by the Government of Bombay in their resolution of the 8th July in which they say :

'Government have heard with great regret of the death on Saturday, the 27th of June last, of Mr. L. J. Sedgwick of the Indian Civil Service. Mr. Sedgwick displayed throughout his official career of over 18 years a steadfast devotion to duty which gained for him alike the confidence of his superior officers and the affection and respect of the people among whom he worked. He was a scholar of conspicuous ability and his special aptitude for ethnology and languages rendered his services of particular value in the responsible post which he held in 1921 of Superintendent of Census Operations. He was at the time of his death engaged in important investigations as Officiating Director of the Labour Office, Bombay.'

A few days later Dr. B. H. Namvatty of Ahmedabad wrote in the *Times of India* : 'I had the pleasure of being rather intimately acquainted with him. I was impressed by his deep knowledge of several Indian languages as well as of science and arts, for he was a brilliant graduate of Cambridge University. His ways were gentle, unassuming and modest, and a very agreeable and prominent feature of his character was that he was devoid of all false or exaggerated notions of pride of race, power or position. He was readily accessible to all, to the influential and to the poor alike.'

By Mr. Sedgwick's death our Society has lost an enthusiastic worker in Botany. He was a keen observer of nature. All his spare-time was devoted to botanical investigations. As a Civil Servant he was stationed in many places and had, therefore, splendid opportunities for the study of plant-life in many parts of this Presidency, from Upper Sind down to Northern Kanara. Wherever he was he added new material to his extensive Herbarium which, during his life-time, was acquired by the Botanical Department of St. Xavier's College, Bombay.

He published valuable papers in the Journal of our Society, in the *Indian Forester*, and in the *Records of the Botanical Survey of India*. His publications show an independent mind which refuses to be tied down by general statements that are not sufficiently supported by facts.

As to his own statements he was almost scrupulously modest and accurate. He had a vast knowledge of systematic Botany. Though of a strictly scientific turn of mind, it had always been his fond intention to popularize Botany in our Presidency. It is a great pity that death put a stop to all his plans and ambitions.

EDITORIAL

We are pleased to be able to announce that Her Highness Maharani Akhand Saubhagyavati Laxmi Bai Sahib Puar of Dhar, who shares with His Highness the Maharaja a keen interest in Natural History and Sport, has recently consented to become a Vice-Patron of the Society and that Her Highness has signified, by a donation of Rs. 5,000 toward the expenses of the museum her approval of the work that the Society is doing in the Prince of Wales' Museum. The Managing Committee of the Society take this opportunity of expressing their appreciation of Her Highness' interest in the affairs of the Society and thanking her on behalf of the members for her generous gift.

As pointed out in the recently issued ' Annual Report of the Natural History Section, Prince of Wales' Museum ' for the year 1925–26, the Annual Grant received from Government for the maintenance of the Natural History Section makes little provision for the supply of show cases and equipment, and the Museum is largely dependent for these on the generosity of private individuals, whose assistance affords us no small encouragement in carrying out the work we are doing. The Curator's Report, to which we refer above, shows that extensive progress has been made in the various galleries of the Section. It is regrettable therefore to read that the absence of suitable show cases for the Reptile and Fish Galleries has largely prevented the development of these two Sections of the museum. The report also indicates that a very urgent need is the building of a suitably equipped laboratory in the museum grounds. At present the work of the Museum Preparation Department is carried on in the Society's Rooms at 6 Apollo Street, which are inconvenient and unsuitable for the purpose. The transport of large exhibits from the laboratory to the museum is one of the minor difficulties with which the department has to contend, particularly when, as was the case with a fully mounted Bison, the windows and masonry have to be removed before the transfer can be effected. A suitable site for the laboratory is available in the museum grounds and it is estimated that a sum of Rs. 15,000 would go far towards meeting the cost of erection but,—there is always a but—it is almost superfluous to add that funds are needed for carrying out the work.

The present issue of the Journal contains a review of Mr. L. R. Loyds' recent book on ' Bird Protection.' The author of the book is at variance with the attitude adopted by the Royal Society for the Protection of Birds. He believes that the methods they advocate are prompted more by sentiment than commonsense. We hope that the Society will carefully consider the case as put forward by Mr. Loyd and the facts which he brings forward in support of his claim. For behind him, as our reviewer points out, is ranged a large body of Scientific Ornithologists and Collectors, amongst whose ranks may be found many of the staunchest supporters of Bird Protection and whose opinions on a subject, on which they are naturally qualified to speak, are worthy of respect and consideration and whose co-operation in a matter of common interest would go far towards the attainment of the end the Society has in view.

The subject of Bird Protection in England brings us to a matter nearer at hand, it concerns the lifting of the present embargo on the export of egret plumes from India. Readers of this Journal will recall the various illustrated articles on the subject of Egret Farming in Sind and other parts of India. These farms are now well established and the trade in their produce could, it is believed, form the basis of a flourishing cottage industry provided the present Plumage Act was amended for their special benefit.

The Government of India are now considering the question of lifting the embargo on the export of *aigrettes* subject to certain conditions. In the main these are as follows :—

Farms would either be licensed or run by Government or recognized Co-operative Societies, subject to such conditions as the local Government might choose to impose. To facilitate despatch through the Customs, the feathers licensed for export would be contained in sealed packets of standard pattern, sizes and weights. Large amounts would be put up in specially sealed bales. These standard containers would be issued by Local Governments and carry the name of the district or sub-division and have a serial number and the date stamped on them. The farmers would be required to bring their produce once or twice a year to the district *tashil* Head-quarters, where they would be examined and sealed up in the standard containers, the farmer paying the requisite fees. He would then be at liberty to take over the sealed packets and dispose of them as he liked.

In producing the feathers the farmer would be required to show his farm license, the amount of the yield being checked against the anticipated output of the farm. If Local Governments appointed Inspectors, it is presumed that they would be able to tell whether the farmer was supplementing his legitimate stock with feathers of wild birds. In such cases the license would be withdrawn. Certain provisions are to be included to give facilities to middlemen and exporters who would be permitted to examine the contents of the packages either before sealing or under supervision of a Customs Officer.

The lifting of the embargo would of course only concern the produce of licensed farms, the ban on the export of plumage of wild birds, would remain in force as at present.

We welcome the opinions of members of the Society, particularly from those conversant with or interested in the subject, as these proposals are now being considered by the Society's Committee who have been requested to acquaint Government with their views on the matter.

In a letter received by the Editors of the journal, the writer comments on the apparently reckless shooting indulged in by the author of an article recently published in the Society's Journal—the Editors wish it to be known that the publication of an article without editorial comment does not imply approval of the methods adopted by the author.

Col. W. H. Evans' profusely illustrated serial on the identification of Indian Butterflies is now nearing conclusion and we are sure that entomologists and collectors would welcome the proposal which we are now considering to issue the series in book form. Every effort will be made to keep the price of the book at the lowest possible figure so as to bring it well within the reach of all who are interested. The edition will be limited to 200 copies. Those desirous of securing a copy should communicate with the Honorary Secretary. Re-publication will of course depend largely on the number of applications received.

Col. R. Meinertzhagen, who has recently returned from a collecting trip in Kashmir and the countries beyond, writes to solicit the help of members in certain investigations which he is now undertaking.

It appears that something can be learned from a study of the grit which certain groups of birds swallow in order to assist them in digesting their food. An appeal is therefore made to those who shoot the following birds, to extract the stomach (gizzard), an operation which any cook can do, and forward them to Colonel R. Meinertzhagen C/o Bombay Natural History Society. The stomach should be complete and undamaged. Six or seven stomachs of each of the small species and four or five of the larger would suffice. It these stomachs are allowed to dry in the open air, or are even cooked they will travel in a small box without smell. The following data with each batch of stomachs is essential—species, locality, month of year. The groups from which stomachs are required are, all Game Birds, including Pigeons and Doves, Sandgrouse, Peafowl, Crane, Bustard, Geese and Duck and Quail. With regard to Game Birds it will be worth examining these in the neighbourhood of the Ruby mines in Burma. Amongst the societys treasures (Burglars please do not note) are 13 Sapphires found in the gizzard of a jungle Cock shot near Mogok.

MISCELLANEOUS NOTES

No. I.—THE SLOW LORIS (*NYCTICEBUS COUCANG*)

Apropôs of the note on the Slow Loris which appeared in a recent issue of the Journal (vol. xxi, No. 1, p. 215) we publish below an extract of a letter received from Major J. D. Scale:—

This curious little animal, from its nocturnal habits and its shyness, is, in these hills, very seldom seen and rarely captured. In addition, the superstition which attaches to it among the non-Christian Lushais, i.e., that disaster will befall the house and inmates responsible for its capture makes it very difficult to obtain a specimen. In some places even to see it is exceedingly unlucky so that I counted myself fortunate to have the opportunity a few days ago of handling one which had been brought in by a Christian Lushai. The man while climbing a tree had seen it asleep in a hole in the trunk below him and had effected its capture with much difficulty, by dragging it from its retreat with nooses of jungle creeper. When brought in, it was trussed up into a ball, but when loosed was in excellent condition, save for a gall on the hind legs from its bonds. It was a male. Its moments were slow and well considered, it never took a pace unless certain of its foot hold, and its power of hold was prodigious. For three days it lived in the bungalow of its owner, sleeping by day on the top of an almirah and at night climbing about everywhere. It ate bananas, fruit and fowl's eggs broken for it. On the third day, whether with the connivance of non-christian friends or no is doubtful, it returned to the jungle and though searched for high and low has not been since seen. There is no doubt that it could shake off its lethargy and move fast if necessary as on one occasion as I was trying to prevent it climbing out of reach, it struck with lightening-like swiftness, and bit my sleeve. The Lushais firmly believe its bite causes vomiting, and a creditable informant states he saw a half-witted boy, who was incapable of reasoning, knew nothing of the superstition and thought that the Loris he had captured was a monkey, vomiting for some time after being bitten. I did *not* attempt to disprove the belief. Its Lushai name '*Sa-huai*' means the haunted animal and the story goes that 'Once upon a time the great chief Thlangrukpa gave a feast to all living creatures. In order that even the most delicate of them, whom the sun's rays might injure, should be present, the banquet was held at night. So enjoyable was it that at sunrise they were still making merry, so a message was sent to the sun asking him to postpone his coming. Very kindly he agreed but being very curious to see the show he peeped over the horizon at which many of the smaller guests scattered away. The loris, sprightly and nimble in those days, was dancing a passeul and furious at the sudden interruption to his "turn" told the sun what he thought of his behaviour. The sun in anger at the insult, swore the loris should never look him in the face again, or wander abroad in his light and from that minute this little creature was afflicted with the groping gait he has to-day.'

LUSHAI HILLS, J. D. SCALE,
ASSAM. *Major.*

[The bite of the Slow Loris is held to be highly poisonous by certain tribes in Assam and the neighbouring provinces. Frayer in his *Thanatophidia of India* gives a very interesting account of the harmful results which followed a bite from a Slow Loris. He quotes the instance as indicating how great is the liability to error ; even when the evidence is complete. This slow, gentle and harmless creature is convicted on the best evidence of poisoning a man by its bite as a venomous snake would have poisoned him. In commenting on the case Frayer wrote : 'The effects so well described by the author were probably due to mental causes, with some co-incident disorder. This is a good example of the necessity of extreme caution in arriving at conclusions, or generalizing on insufficient data.' *Eds.*]

No. II.—THE OCCURRENCE OF HODGSON'S BAT (*MYOTIS FORMOSUS*) IN THE CENTRAL PROVINCES

While compiling a list of the mammals inhabiting the Central Provinces and on going through and examining the material in the Nagpur Museum, I was a bit doubtful of the identity of a bat, presented by my predecessor, which I had put down as Hodgson's Bat, *Vespertilio formosus*. I have now sent the specimen for verification to the Bombay Natural History Society and they have confirmed my identification. It was taken at Nagpur in a bungalow which it had entered.

NAGPUR MUSEUM, E. A. D'ABREU, F.Z.S.

30th June, 1925

[The distribution of this beautiful bat is given as the 'Himalayas near Mussorie up to 3,500 feet, Nepal, Sikkim Assam, Khasi Hills, Bengal, Calcutta, Purneah, Chabassa and China. Its discovery in Nagpur, C. P., indicates an extension of its known habitat.' *Eds.*]

No. III.—THE SAMBHAR CALL OF TIGER

Your readers will be much interested in Major James' letter and your summary of the various notes on the above subject (Journal, B.N.H.S., vol. xxx, p. 462). You will pardon me however, if I venture to differ in your interpretation of Major James' experience.

Major James does not say that the tiger was meditating any attack on the Sambhar or that it was even stalking it : in fact the whole behaviour of the tiger contradicts this : had it been intending an attack its whole attention would have been focussed towards the sambhar—it would either have been almost invisible, or proceeding towards the sambhar at a belly crawl, or in flashes, like a live wire, and instead of this it was standing up, flanks heaving and head lowered, to make the call. This is not the way a tiger hunts. Major James specially mentions tigers are scarce when he met this one. Is it not more likely that the tiger heard the sambhar moving without knowing what it was, and gave it a call ?

In your summary of views on the subject you have been good enough to refer to my brief remarks on the subject contained in *Wild Animals in Central India*. I may be permitted to amplify these. There are many baffling points in connection with this call. To begin with no two people interpret the noise in the same way. Does the call vary to the extent one would suppose, and is there more than one call ? I have only heard one : like a soft low sambhar call. The only medium of describing sound is to liken it to some other sound.

Again, tiger are much more addicted to the call in some places than in others. I have only once heard the sound outside *sal* forest and, but for this instance, I would have been almost tempted to say that it is not uttered in the teak forests. It is significant however that all the calls of tiger are far more commonly made in *sal* forest as compared with teak forests. A friend of mine, of vast experience and a most accurate observer, has never heard it in teak forests. It is a fact that the most experienced shikaris exported say from

Chanda to Mandla or Balaghat will not credit the local *Baigas* when they assert that the noise is made by a tiger. Col. Faunthorpe, late Commissioner of Lucknow and a mighty hunter, told me he had never heard it. His experience was of the Terai.

I am convinced the origin of the call has to do with a mate: this includes *finding* a mate; *keeping in touch with* a mate, or a note of *interrogation or enquiry* for purposes of identification towards a noise or a disturbance: a potential mate? These are the only motives which are consistent with my experience. A number of times I have been able to follow the course of a tiger striding across a grass maidan in Mandla by the call being repeated every two or three hundred yards. There is no element of fear or disturbance in this. Two tigers together, one or both being disturbed, keep in touch with each other by this call. There is no essence of hunting in this; and I have never known a case of a *single* tiger make the call when the disturbance has been identified, but they will making it when they do not know what is a foot. It is very difficult to be certain if a tiger has identified a disturbance: also whether it is in touch with a mate or not: the fact that the great mass of tigers on thousands of occasions make no noise on being disturbed makes it necessary to look for some other cause or causes for the call than disturbance alone. It must be borne in mind that in a great number of cases in which the call is heard *disturbance* is taking place: there is a very great danger therefore of associating the call with disturbance, without searching for deeper causes.

Since the publication of '*Wild Animals in Central India*' I have received a number of very interesting letters from all parts of the world from perfect strangers. One of these was from Mr. Robert Cardwell of the Eastern Express Telegraph Co. Ltd., Cocos-Keeling Island, December 3, 1924. He is evidently well acquainted with the Malay Peninsula, an interesting country about which little is published. I make him my apologies for quoting from his letter without having obtained his permission. He writes as follows:—

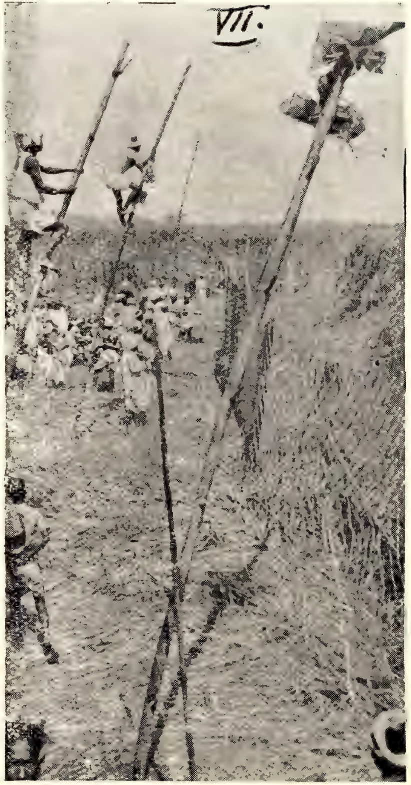
'I am particularly interested in your description of the tiger's peculiar "fook" or "koi" as I interpret it—for so many books seem to ignore or say very little about it, and often when hearing the cry I have wondered the reason for its utterance. It would appear that this cry is uttered far more frequently in some places than in others. In Cochin China, or at least in those parts that I have shot over, this call may be heard almost nightly and particularly so at certain seasons when the young grass is springing up after having been burnt, with the consequent influx of deer and other game. Sometimes it is uttered so frequently that it is quite possible to tell in which direction the tiger is moving. As you say, it is quite out of the question it being uttered as a decoy cry: for no one who has heard it a few times could possibly mistake it with the belling, or even the note of alarm of sambhar, so that there is no possibility of any deer being taken in by it.

I think that your explanation of it being a mate call must be the correct one, but, so far as my observations go, the call is seldom answered by a second tiger. A peculiar incident happened to me once when crossing a small plain by bullock cart on the way to some tsaine ground. I shot at and wounded, a hog, deer which we could not find at the time in the knee high grass: but on our return after nightfall, a dog, which was following the cart-discovered the wounded animal which started to cry out on being worried by the former. Before we could reach the deer two tigers "fooked" from the nearby jungle, one of which approached at a rapid pace across the plain towards the deer, still "fooking" all the while: when it got within a hundred yards or so off us, (as seen next day)—it evidently discovered our presence for it turned away, still "fooking" till it had entered the jungle once more on the opposite side of the plain.'

In reply I asked Mr. Cardwell if the period when the grass is burned coincided in any way with the approach of the mating season. It is obvious that the concentration of game means also that of tigers and this without other reasons would account for the greater frequency of the call. The story of these two tigers is only consistent with the call being a mate call.

March 24, 1924. A. A. DUNBAR BRANDER.

TIGER NETTING IN ASSAM

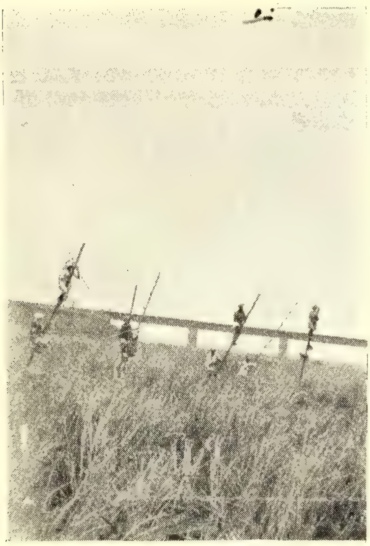


No. 1.
Men pulling on one of the
'Dhenki' Ropes.

No. 2.
A small portion of the
spectators.

No. 3.
Tiger rushing across the
enclosure.

No. IV.—TIGER-NETTING IN ASSAM



Bamboos in position with men on the look out.

The indigenous plains population of Assam are notoriously a pleasure-loving, simple, and more or less idle folk. At least so reckoned in present times when everyone must be up and doing if he is to survive in the struggle for existence.

In this Province, where the soil is rich, the people's requirements few and easily met, and with a traditionally benevolent Government, the people are extremely improvident, and give up much time to festivity, revelry, and romantic idleness.

The women-folk perform not only all the household duties ; the nursing and tending the children, the collection of fuel, and the cooking of the food, but also bear the brunt of the work in the fields.

From the · time of harvesting the mustard crop, till the rains have properly set in and the ground is nice and soft for ploughing, i.e. from about the end of February till about the end of May or beginning of June, we find the fields abandoned, cattle let out to graze untended, all grass lands contiguous to habitations burnt (to secure safety for the cattle, to provide fresh crops of grass for the cattle, to render themselves immune from accidental firing of such grass areas, and largely to provide themselves with a supply of fuel from the unburnt ekra stems) and all the inhabitants holding inter-village carousing.

At this time whether on account of the opportunity afforded by the absence of cattle attendants, or due to the fact that it coincides with the breeding season of tigers, or that the cattle wander further afield, or the combination of all these circumstances, the number of cattle killed even in a single day seems sometimes incredible.

The wholesale destruction of their cattle soon rouses the inhabitants from their supine placidity, to combine and take concerted action against the common enemy, on the shortest notice at a given signal.

In this District the people who go in for tiger-netting are the Lallungs, the Cacharies, the Koches and a few Hera villages.

For this purpose each male adult of the village has to provide two nets, made from ½ inch diameter jute rope ; each net being about 100 feet long by about 15 feet wide, with meshes 6 inches square. A rope about ¾ inch diameter passes along both top and bottom of the net and serves for binding the two ends.

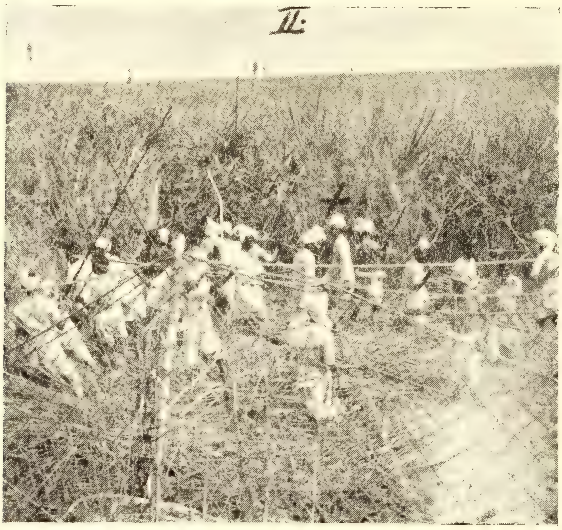
New nets are used each year, or where old nets are used they are doubled.

Having decided to net a tiger, the first kill that occurs is closely examined by a party of about ten to fifteen men who go out armed with spears to investigate. If they are satisfied that the tiger is still not very far from the kill, messengers are sent out in all directions to neighbouring villages (some sometimes 5 miles away) to call all able-bodied men, and to bring all available nets, spears, bamboos, drum, cymbals, and every other contrivance for producing the most diabolical noises conceivable.

The spot most likely to hold the tiger is then partly netted on the outer side, while the rest of the area or adjoining area, if very large, is divided into two or three blocks by breaking down the grass in straight lines. A systematic beat of each block is then carried out, beating towards the netted area ; at the same time men are posted along the cleared lines to intimate when a tiger or tigers break across.

When a tiger is driven into the partly-netted area, the men promptly form a cordon round, whilst others complete the surround with nets as quickly as possible. The top of each net is kept in position by passing the main top rope of the net and one of the meshes over and into the horns formed from bamboo uprights, while the bottom is similarly held down by inversed bamboo forked pegs. The bamboo uprights are about 8 to 10 feet long of which about one foot is driven into the ground.

Long bamboos with the side branches left for about 6 to 8 inches from the culm are then erected all around the enclosure, and serve as look-out posts, to watch the movements of the tiger and to direct the dragging of the log to be described hereafter. (The Photo alone shows these bamboos in position with the men keeping a look-out.)



Men entering the nets.

Having located the tiger at one side of the enclosure, the *Kaviraj* or tiger-doctor performs his *mantras* and enters the net at the opposite side. He is then followed by about 60 to 80 men armed with spears. (Photo 2 shows the men entering the nets.—The *Kaviraj* is shown by a X.)

These men proceed to break down the grass, i.e. the front ranks break down the grass whilst the rear ranks form a semi-circle with their spears, in case the tiger should charge from a side.

Finally having reduced the area to about 50 yards diameter, with the grass broken down all round inside to a width of 10 to 15 feet, a log of wood called a ' dhenki ' is fastened at the two ends by two long bamboo ropes (about 3 inches diameter) and dragged backwards and forwards, to break down the grass, as well as to make the tiger rush about the enclosure to the amusement of the spectators. The ' dhenki ' is about 10 feet long and about 10 inches diameter. (In the Plate, Fig. 1 the men pulling one of the ' dhenki ' ropes are clearly seen.)

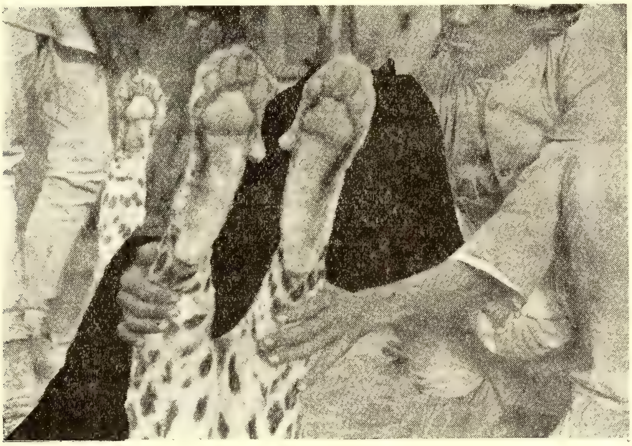
At the outset the tiger often rushes the nets and could be easily despatched, but, according to custom, strict orders are given not to do this, to allow spectators for miles around to come and see the ' tamasha '. When the tiger rushes the nets he is beaten back with the buts of the spears. (Fig. 2 of the Plate shows only a very small percentage of the spectators who often number several thousands.)

Watch is kept day and night, and the place takes on the appearance of a circus or theatre. The performance sometimes lasting five days, by which time the tiger is well nigh dead of thirst and exhaustion, while the netters themselves can scarce keep up the strain which earlier excitement had helped them to undergo, and they decide to finish him off. (Fig. 3 shows the tiger in one of his rushes across the enclosure).

At the signal for finishing him off, each man on a bamboo arms himself with a spear.—The 'dhenki' is dragged towards the tiger who, as it approaches, charges it, sometimes biting the rope in two, and then makes for some point in the nets, where he is greeted with a flight of spears, both from the men on bamboos as well as the men surrounding the nets. The end is speedy; for as the tiger is more or less pinned down the men see red and the lust for blood is given full rein to, the crowd surges forward pushing in the nets and were he a leopard he would have as many spear thrusts as he has spots. (Photo 10 shows the last of a notorious cattle-lifter.)

NOWGONG, ASSAM, L. J. DELANOUGEREDE,
June 1925. *D. F. O.*

No. V.—PANTHER WITH ABNORMAL FEET



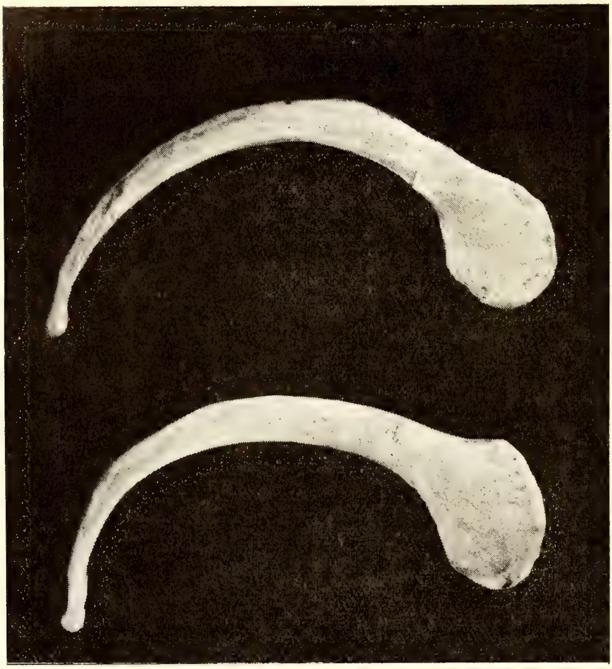
Abnormal Feel of a Panther.

On the 28th January, 1925, I shot a Panther at a place about 2 miles to the north of the village of Jhikadi in the Bhuj District. He was a full-grown male, in excellent condition and measured 6 feet 11½ inches between uprights and 7 feet 1 inch along the curves. He had an extra abnormal toe on each hind foot on the inner side of the leg. These toes were little round balls of fleshy substance with no bones in them and were merely attached by the skin, but there was a claw (non-retractile) on each toe. The toes were placed in a line with the back of the pads, rather high, but the extra claws were quite useless. A freak of this kind has probably been noticed before, however, the present instance may be worth recording and the photographs accompanying this note may interest the readers of the Society's Journal.

BHUJ, KUTCH, MAHARAJ KUMAR SHREE VIJAYARAJJI.
29th April, 1925.

In Volume XI, p. 734 of this Journal Mr. S. Eardley-Wilmot refers to a panther, shot by him in Oudh, with five fully developed claws and toes on each hindfoot. *Eds.*

No. VI.—ABNORMAL CLAVICLE BONES OF A TIGER



Abnormal Clavicle Bones of a Tiger.

I enclose a photograph of two clavicle bones taken from a 9 feet 7 inches tiger which I shot on the 29th April in the Pahalgarh Estate, Gwalior. The tiger, though not very long, was extraordinarily massive and heavy.

I believe the shape of these clavicle bones is unique. The upper one is 4¼ inches long round the curve measured from the red mark on the outside of the flattened head. The lower bone is 3¾ inches in length.

MANPUR *via* MHOW,
14th May, 1925.

W. G. HUTCHINSON,
Lieutenant-Colonel.

[The clavicle or collar-bone is often rudimentary and very frequently entirely absent in mammals ; in the Primates the collar bone is well developed, in the Bats it is very long and curved ; in a few forms of the *Rodentia* it is altogether absent in Cetaceans and in Ungulates it is always absent. In the Carnivores the clavicle is sometimes absent and varies much in its development, thus, none of the Fin-footed Carnivora (*Pinnipeda*) such as the Seals, etc., possess a clavicle bone. When present, it varies much in its development, but is always rudimentary and suspended in the muscles, that is to say, instead of the collar-bone forming a bar to connect the shoulder blade with the breast-bone, as in man, it merely forms a splint of bone embedded in the muscles of the chest between these two points. In the *Felidæ* it is slender and curved—being longer than in any other members of the order—in the *Canidæ* it is very short and rather broad and flat—in most of the Bears it is absent. *Eds.*]

No. VII.—PANTHER AND WILD DOGS

On the evening of 31st May, 1925, I had a clear case of a large male panther driving wild dogs off his kill.

A tethered buffalo calf had been killed by this panther, but a thunderstorm prevented my going to the *machan* until late in the evening. Two men went on in advance to tidy up the screen. Following a few minutes later I found them returning to say that the nullah was full of wild dogs and they had been afraid to go on. I sent back to camp—not far away—for my shot gun; and by the time I got to the place, shot gun in hand, the light was very bad. There were no wild dogs, but a large grey shape could be seen tugging at the kill. The nullah being wide and stony no nearer approach could be made. The distance was 50 yards. Twice the panther's head could be made out turned in the direction of myself and the man with me, but he seemed little concerned and renewed his efforts to remove the kill. Exchanging the gun for a ·470 rifle I sat down, raised the enamel foresight disc., and took a careful shot, fully hoping to lay the beast out. The bullet went high, doubtless because the back sight was not sufficiently defined.

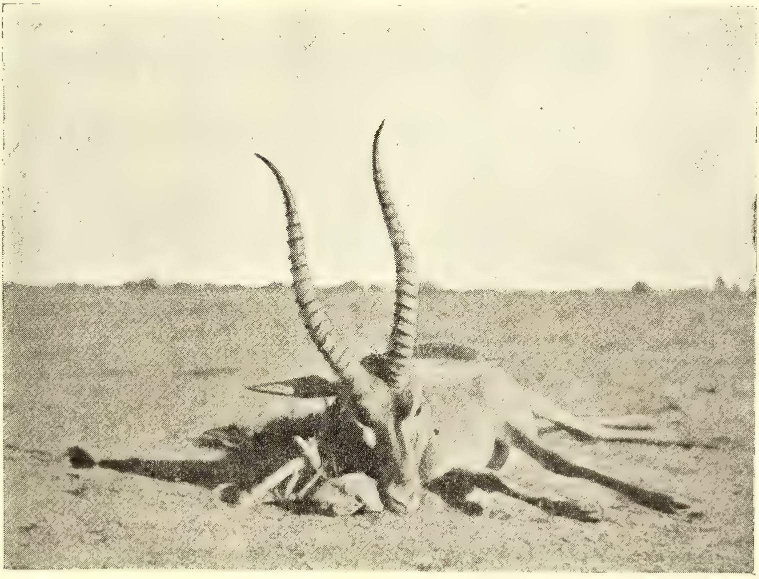
Except for the fore part of the kill the dogs had picked the bones of the carcase pretty clean. At daybreak next morning they turned up again; two large dogs and seven pups of some 7 to 8 months old, as far as I could judge by dentition of one I shot.

It was fully evident that the panther had arrived on the scene, immediately after the two coolies turned back, and driven the dogs away. Had the pack contained more full-grown dogs he would probably have been less successful.

QUETTA, LT.-COL. R. W. BURTON
7th July, 1925. *Indian Army* (*Retd.*)

No. VIII.—A HYBRID BLACK BUCK (*A. CERVICAPRA*) AND CHINKARA (*G. BENNETTI*)

(*With a Photo*)



Hybrid.

The Hybrid as you will see from the photographs is an extraordinary animal, and was found with a herd of Blackbuck. It used to fight and drive away the other Blackbuck in the herd and was an absolute master of the herd. The colour was almost that of a Chink but some black hair were visible here and there. It was bigger than the ordinary Chink and the shape of the face was not altogether that of a Chink, but somewhat resembled a young Blackbuck. The tail was black exactly like a Chink. In build it was slightly bigger than a Chink. The horns were a curious mixture of Blackbuck and Chinkara. They started out of the head like the horns of a Blackbuck whilst the tips resembled those of a Chink. Its action and the way it carried its head were more like a Blackbuck than a Chink. As this animal lived in a Blackbuck herd, I presume that the father was a Chink whilst the mother was a Blackbuck doe, for if the mother had been a Chink it would not have been found with a Blackbuck herd.

BIKANER,
13th February, 1925.

MAHARAJ KUMAR SRI SADUL
SINGHJI BAHADUR

No. IX.—DUEL BETWEEN TWO BULL ELEPHANTS

The following incident which resulted in the death of two wild elephants took place in the Feudatory State of Athmallik, which borders on the Mahanadi River in Orissa. The story was related to me by a local official and I visited the scene of the struggle about four months after its occurrence. The State contains some extensive tracts of forest watered by perennial streams which afford a sanctuary to wild elephants throughout the year.

During the month of February 1924 news reached the head-quarters of the State that two bull elephants had been fighting and that one had been killed. This news was received four days after the actual combat took place, and on further investigation the body of one elephant was found while the second was discovered in the jungle close by badly wounded. The survivor was successfully captured by means of trained elephants and was kept tied up in the vicinity for a few days but when an attempt was made to take him out of the forest he succumbed to his injuries.

Unfortunately four months elapsed between the above occurrence and my visit to the scene, so that although I saw what remained, it was impossible to detect any of the injuries from which the elephants died. Both were single tusker bulls, the tusks weighing 45¼ and 44¼ lbs. respectively.

I relate the above episode as I should imagine that it rarely that one of these combats ends in a double fatality, although many must be severely injured during such encounters.

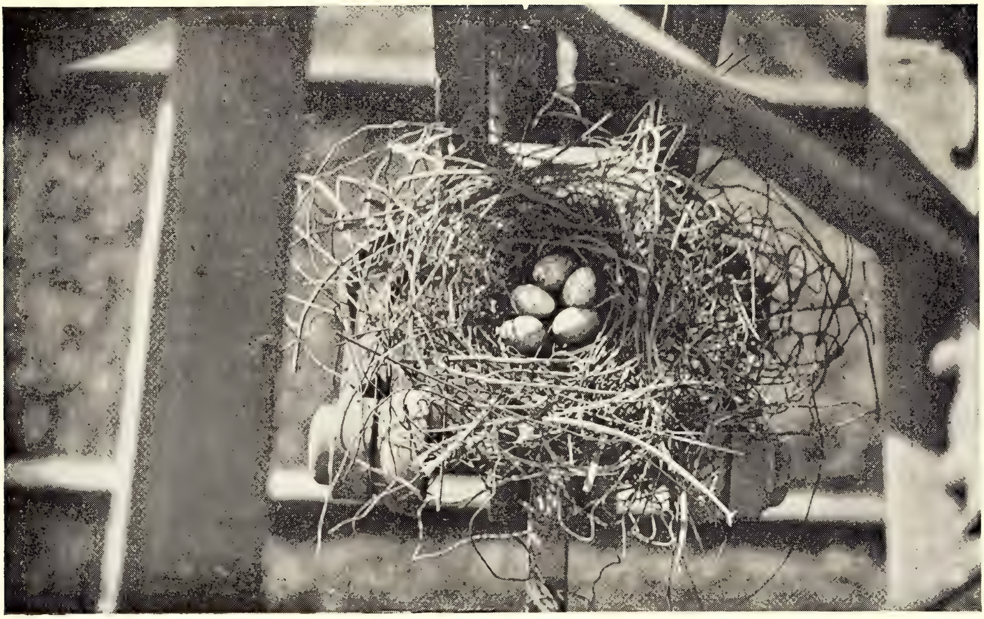
SAMBALPUR, B.N.Ry.

H. F. MOONEY, I.F.S.

No. X.—AN ELEPHANT TRAP

There is a form of trap figured in Sir Aurel Stein's *Serindia*, which is widely used in Africa and I am anxious to discover how far it is still in use in Asia. I append an extract from Bell's book *Wanderings of an Elephant Hunter* which describes the method of using the trap.

'A well frequented elephant path is chosen and somewhere near the spot ' decided upon for a snare a large tree is cut. Judgement in the choosing of ' this must be exercised as if it is too heavy the snare will break, and if too light ' the snared elephant will travel too far. A tree trunk, which ten or twelve men ' can just stagger along with, seems to be the thing. This log is then brought ' to the scene of action and at its smaller end a deep groove is cut all round to ' take the noose at one end of the rope. After this noose has been fitted and ' pulled and hammered tight—no easy matter—the log is laid at right angles to ' the path with the smaller end pointing towards it. A hole, a good bit larger ' than an elephant's foot is then dug in the path itself to a depth of two feet or ' so. Over this hole is fitted a wooden frame work similar in shape to a cart ' wheel with spokes but without a hub. Round its rim the large noose of ' the snare is laid and the whole is covered carefully over with earth to resemble ' the path again. The snare is now laid, and if all goes well some solitary bull ' comes wandering along at night, places his foot on the earth borne by the ' sharp spokes of the hubless wheel, goes through as the spokes open downwards, lifts his foot and with it—the wheel bearing the noose well up the ankle, ' strides forward and tightens the noose. The more he pulls the tighter draws ' the noose until the log at the other end of the snare begins to move. Now ' alarmed and presently angry, he soon gets rid of the cart wheel, but its work ' is already done, that does not matter. The dragging log is now securely ' attached to the elephant's leg, and it is seldom that he gets rid of it unless it



No. 1.
Crow's nest (weight 11 lbs.), made almost entirely of wire, built on the side strain insulator Brackets.

No. 2.
Crow's nest of wire in process of construction on the over-head girder.

' should jamb in rocks or trees. Soon he becomes thoroughly alarmed and sets ' off at a great pace, the log ploughing along behind him. Should a strong, ' vigorous young bull become attached to a rather light log, he may go twenty ' or thirty miles.'

Court Leys, C. G. SELIGNMAN.
Toot Baldone, Oxford.

No. XI.—CROWS NESTS AND ELECTRIC CABLES

The G. I. P. Railway, since the inauguration of the new electric service in Bombay, was faced with a novel problem intimately connected with the nesting habits of the Bombay crow.

The Bombay crow on looking round for a nesting place decided that the overhead gear which carries the electric cables offered a safe and satisfactory haven in which to bring up its family. The Bombay city crow has advanced ideas in nest architecture and commonly builds itself a nest of wire or hoop iron in preference to the more common-place twigs.

Mr. R. McLean, agent, G. I. P. Railway, has very kindly forwarded us the following particulars :—

During the months of March, April, May and June 62 insulators were damaged by crows, causing a loss of 43 hours on the service ; this loss was spread over 433 trains. From observations taken the trouble was usually caused by the crows either attempting to build their nests on the side strain insulator brackets, as shown in photograph No. 1 or by the crow alighting on the structure near the ' live ' line with a length of wire in its break and the wire coming in contact with live metal. The wire started an arc which, though small at first, spread to the heavier metal of the line and structure and so continued until the insulator was completely burnt down.

In one instance the Catenary Cable, 1 inch in diamater was burnt through. The crow apparently prefers metal such as wire, hoop iron, etc., to twigs for building its nest, for it was noticed that wherever such material was available, the nest was composed entirely of wire with a thin lining of straw or cocoanut fibre. The compositions of the nests varied on different sections of the line. Near Masjid (in the heart of the city), the nests were of small pieces of light hoop iron, probably brought from the metal yards in the neighbourhood. Near the Cotton Green, they were of iron wire such as is used in reinforced concrete construction. Near Kolwada in the suburbs, where no such supplies of metal were available, the nests were of twigs and were not dangerous from our point of view. Near Kurla, they were of twigs and wire.

The crows were most persistent in building on the structure where they had first chosen to build and after the nest had been taken down, returned time after time to rebuild. Early in the season they would rebuild the nest in about three days, but later the new nest would be built in a few hours.

Another interesting point noticed was that the crow did not sit in the nest at night if it was composed of wire, but roosted in a tree close at hand. The wire nests in such cases were found to be quite warm even at 2 a.m.

The statement made in the press that only one crow had fallen a victim to the power is incorrect. Twenty-nine crows were found dead at the site of accidents. They were invariably badly burnt and nearly all their feathers were charred. In two instances a crow flew away leaving its legs behind stuck to the structure as an effect of the arc.

As an emergency measure the railway decided to fix asbestos sheets over the brackets to prevent wires from resting on the ' live ' ' pull-off ' rod, and so far the fitting of these sheets has been entirely satisfactory.

The crow, however, not to be defeated, has now moved his habitation higher up the structure and photograph No. 2 shows a nest in the overhead girder itself. The chances of wires coming into contact with live parts of the structure are, of course, very much less in the new location, but an examination of the photograph with a magnifying glass will show the great lengths of wire that have been used in making his nest, so that the danger is by no means entirely eliminated.

Bombay Natural History Society, S. H. PRATER,
15th June, 1925. *C.M.Z.S.*

No. XII.—PREDATORY HABITS OF THE MAGPIE

In the Tsangpo valley on 14th July, I came on a Black-rumped Magpie (*Pica pica bottannensis*) having an almost fully-fledged lark in its mouth. The parent lark was attacking it and the young bird struggling to be free. I rode after it to try and make it drop its prey but it refused to do so and flew on a few yards at a time. At last seeing that the young lark was dead, I left the Magpie to its meal.

GANGTOK, SIKKIM
11th May, 1925.

F. M. BAILEY,
Lieutenant-Colonel.

[The food of the European Magpie (*Pica pica*) is stated to consist mainly of insects but also carrion, small mammals (rats, mice, voles), young birds of many species and eggs and vegetable matter. The other forms of the species which occur in N.-W. Africa, parts of Asia and N. America are probably equally carnivorous. *EDS.*]

No. XIII.—FRESH LIGHT ON THE IDENTITY OF THE 'DEVIL BIRD.'

With reference to the note on the above subject which appeared in the last issue of the Journal, our readers will be interested in the following extract from a paper on 'The Devil Bird' read by Dr. Spittel before the Natural History Society of Ceylon and printed in the *Times of Ceylon*, 11th June, 1925. Dr. Spittel gives an exhaustive and interesting account of the many theories which throw light or tend further to obscure the identity of this elusive creature, and, from questioning scores of people met with during his wanderings, sifting carefully the evidence he got and discarding all doubtful data, he has come to the conclusion that :—(1) the Devil Bird was no *owl* but an *eagle* and was crested ; (2) it was a large bird and (3) was streaked in its breast plumes rather like a jungle hen.

Dr. Spittel writes :—

'I had come to a dead end ; for I knew that with my limited opportunities for visiting the jungle, I could not hope to add the final touch of proof necessary, by securing for myself a specimen of the bird while it cried, or even seeing one that had been shot by a reliable informant.

I now told Mr. E. C. Fernando, the Colombo Museum taxidermist, all I knew about the Devil Bird and suggested to him that the only way to clinch the doubt would be for him to try and shoot the bird while it cried. This, I had no doubt, he would, sooner or later, have the opportunity to do when camping in the jungle collecting specimens ; for he is a young and ardent sportsman with a good knowledge of birds.

A couple of months ago I was pleasantly surprised to hear from him on the telephone saying he had shot the Devil Bird and had several specimens to show me.

'What bird is it ? ' I eagerly asked.

'The *Spizaëtus cirrhatus*,' said he.

Then felt I like some watcher of the skies !

The circumstances under which he had shot the bird were these :—

Towards the end of November 1924 he was camping at Divulana, when often at night he heard the hoots of the Devil Bird, coming from a certain direction. He also observed that a 'harsh cough' often immediately preceded the hoo-oo, and conjectured that the first note might be the male's and the second the female's.

May I be permitted a digression here. The triple 'hu-hoo-hu' cry of the Brown Fish-owl (*Ketupa zeylonensis*) almost running into a single note, very likely comes from two birds ; the first 'hee' of the male usually being immediately succeeded by the hoo-hu of the female. Calling my attention to these notes, a forest Tamil once told me that the male owl tells the female, 'when I cry once, if you don't quickly cry twice, I shall choose another mate.' Who knows but that some such understanding may also exist between Devil Birds ! But this I rather doubt ; and it may be that the same bird tunes up from the harsh guttural to the higher and purer note. On the other hand, there can be little doubt that it only indulges in one or other of these notes at different times ; for those acquainted with the ' hoo ' have often not heard the ' strangulation cry ' and *vice versa.*

To come back to Mr. Fernando's experiences : One afternoon he shot a large bird that had swooped down on some prey on the *bund* of Divulana Tank. A few days later he shot another on a big tree in a close forest. It did not occur to him to associate these birds with the sounds he had heard at night.

On his return journey, he spent ten or twelve days at a forest ranger's bungalow at Vellavaly—the veritable home of the Devil Bird for here it could be heard invariably every night.

Some 30 yards from the bungalow was an ' aar ' flanked by giant kumbuks. Towards dusk he often noticed that certain large birds came there to roost ; it was from this direction the cries came. At about 6-30 one evening he was loitering under these trees when the harsh throaty chuckle he had so often heard proceeding the 'hoo' cry made him look up ; and there, seated on a branch was the bird from whom the horrible noises came. He shot it. It was not different from the two birds he had secured on the Diyulana *bund.* They manifested the essential particulars I had given him of the Devil Bird—a large crested bird mottled like a jungle hen in its breast feathers, and its back feathers the colour of burnt earth as Veddas had put it.

The next day, when it was even darker, he shot a similar bird, making the same noise, on a neighbouring tree ; but its plumage was much lighter than that of the others—presumably a maturer bird. Two days later he shot a fifth bird under similar circumstances. All the specimens were those of the Ceylon Hawk-Eagle (*Spizaëtus cirrhatus ceylonensis*). He saw no other bird about that might possibly have uttered the cries.

In the stomach of two of these birds he found weaver birds, and in that of another, a green lizard. These birds are said to breed early in the year, and that perhaps accounts for their being so noisy about December.

The bird is evidently diurnal in its habits but like the fishing eagle cries fitfully at night while roosting on large trees by ' aars.' Veddas have told me that they plume their arrows with the feathers of ' Ulamas ' and owls which they pick up along dry stream beds.

The cry of the Devil Bird is generally heard early in the night, at midnight, and towards dawn. The ' hoo ' cry can be heard far, the guttural gurgle only at close quarters.

Two Devil Birds are seldom or never seen in company. While foraging singly during the day, they apparently roost together at night, but often perhaps wander away started by what power who knows, waking the forest with their unearthly cries.

This is the evidence I have that the Devil Bird is none other than the Hawk-Eagle (' *Spizaëtus cirrhatus* '). To me at least it seems convincing. I feel we owe Mr. E. C. Fernando a great debt of gratitude for taking us well towards the solution of a difficult problem.'

[Commenting on the above Mr. A. P. Kinloch writes :—' The shrieks of a pair of Birds are heard at a distance, answering each other they gradually approach and then recede and die away.—Does the Hawk Eagle go in for such lengthy nocturnal promenades ? Why should a bold diurnal bird like the Hawk-Eagle reserve this cry for the still watches of the night ? It is as unlike his ordinary cry as a bulbul's conversation is to a racket-tailed Drongo's carellon of bells.' *EDS.*]

No. XIV.—HAWKS AND SWALLOWS

The following curious information may be of interest, and similar cases may be known to readers of the Journal, in which case I should be glad to have the facts substantiated. I am told that there is a high cliff in this district which is the nesting place of innumerable swallows. My informant visited the place many years ago and gives the following details. Every ledge and crany is covered with nests, globular in shape and made of mud, each nest having in front of the entrance a hanging curtain of mud mixed with fine feathers. This is apparently a precautionary measure, a means of camouflaging their abode from the enemy above, for the cliff overhead is the haunt of a species of small hawk known to the Lushai as *Mu-ral* (swallow — killer). These birds live on their neighbours below, taking continual toll from the swarms always flying about the cliff. There is nothing very strange about this, but what is curious is that the hawks are gourmets of the most merciless kind in as much as all they deign to eat is the brain of their capture and strew the ground below with bodies uninjured except for the skulls. If this is the case, and I see no reason to doubt the veracity of the narrator, it would be interesting to know how this epicurean taste originated, necessitating, as it must do, so much more effort. The story seems vaguely familiar, though possibly this may be due to its recalling the blood-thirsty habits of the Kea Parrot of New Zealand. Is it not possible that originally the hawk struck at the baby heads peering out of the nest thereby gaining the ' brain ' taste, and also causing the hanging of the camouflage curtain. Now that the nests are no longer easy of attack, he has to be content with the older birds ?

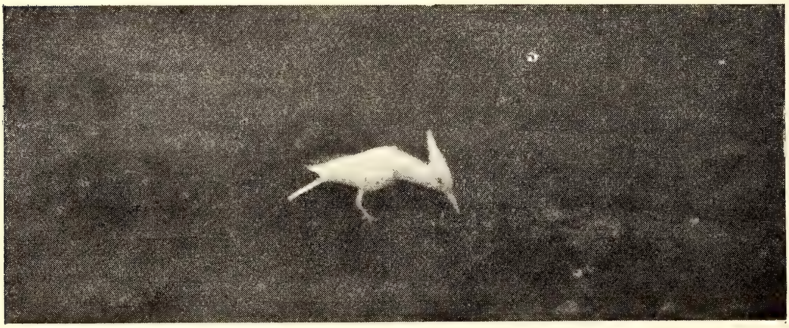
The scene of this swallow tragedy is over forty miles distant from my head-quarters, through dense jungle and is therefore difficult to visit but should no verification of the facts from other localities be available, I hope to substantiate the story before leaving the district. A detailed description of the hawk is unluckily not obtainable.

AIJAL, LUSHAI HILLS,
9th March, 1925.

MAJOR J. D. SCALES, D.S.O.,
O. B. E.

[Major Scale's note regarding the hawks which live on swallows and the formation of the latter's rest is of very great interest, especially the fact that they only eat the brain of the birds they catch. This is very unlike any of the hawk tribe, for, though every hawk loves the brain and eats it first, they are not given to wasting any portion of their victims. Mr. C. H. Donald, to whom we submitted Major Scale's note, suggested that the hawk referred to is possibly a hobby that has taken to eating swallows and given up its usual diet of insects. We look forward to receiving from Major Scale a specimen of the hawk referred to by him and also examples of the swallows with their curious nests. The protective screen described by Major Scale is a feature which we have not seen connected with the nest architecture of any of our Indian swallows. *EDS.*]

No. XV.—AN ALBINO HOOPOE (*EPOPA EPOPS INDICA*)



(*With a Photo*)

I send herewith a photograph of a white hoopoe, taken in our garden at Bikaner. The bird is totally white, including its crest. Other hoopoes display no hostility towards it, but it seems to be tamer than most and seldom leaves the garden.

DURNAM COTTAGE, DALHOUSIE,
2nd July, 1925.

(MRS.) H. K. RUDKIN.

No. XVI.—OCCURRENCE OF THE NEPAL KALIJ PHEASANT (*G. LEUCOMELANUS*) AT MUSSOORIE

I am sending you the skin of *Gennæus leucomelanus*, the Nepal Kalij Pheasant, shot here in December last year. It may be of interest to record this, as, as far as I can find out, no one has either observed or recorded this bird from anywhere here. The books too, do not mention Mussoorrie or it neighbourhood. There is only one place here where it is found to my knowledge, i.e., Lyndhust Spur near the Botanical Gardens. I got the birds in this spur—one, the present skin and another young cock. Unfortunately I missed the hen that got up with the bunch.

I have made enquiries from a number of old shikari residents and no one appears to have noticed this bird about here. It does not seem to be generally distributed about these hills as I have never seen it, though may have overlooked it with *G. albocristatus* which is very common about the hills round here. Of course others may have overlooked it also or failed to notice it.

Mussoorie, U. P., F. FIELD.
13th April, 1925.

[The skin sent by Mr. Field is undoubtedly an example of the Nepal Kalij Pheasant *G. leucomelanus*, there may be a possibility that some Raja maintains an aviary near Mussoorie, the specimen sent by Mr. Field certainly does not look like a captive Bird. [*EDS.*]

No. XVII.—BREEDING OF THE PAINTED SAND-GROUSE (*PTEROCLES INDICUS*) IN THE PUNJAB SALT RANGE

On 16th March this year, in the Jhelum portion of the Salt Range, I shot a hen Painted Sand-Grouse from a nest containing two eggs. The locality was the stony hills lying south of the village of Dalwal, at an altitude of from 2,000 to 2,500 feet. The nest was on a rocky slope rising gradually from cultivated fields and seamed with small nullahs. The slope was covered everywhere with loose stones and dotted with small bushes, chiefly 'Bahekar' (*Adhatoda vasica*) and a very thick and prickly bush known locally as 'Kander.' There were also a few stunted 'Phulah' (*Acacia modesta*) and Lahura (*Tecoma undulata*) trees.

The nest was a slight depression scratched in the earth between some stones, and the eggs were lying on a small pad of dry grass much resembling chaff. The nearest bush was a 'Bahekar' about five yards distant. On my approach the bird sneaked away from the nest, and after going a few yards squatted flat between two stones, assimilating so with its surroundings as almost to defy detection. Having been watched thus for about a minute it rose and flew into a small nullah close by. I followed and secured it when it rose again, almost from my feet.

The two eggs were slightly incubated and dissection showed no trace of a third.

For the correct identification of the bird I am indebted to Mr. H. Whistler, to whom the skin was sent.

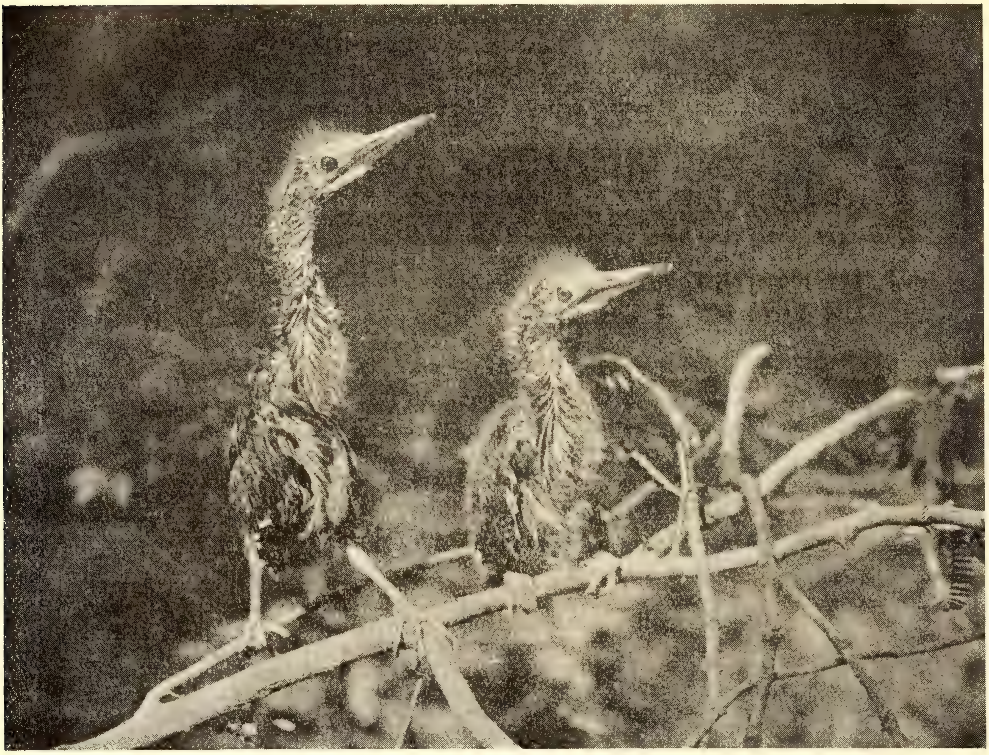
A clutch of three similar eggs, in an advanced stage of incubation, was brought to me last year, having been taken from a nest a few hundred yards from that described above. The parent bird was not secured, hence my visit to the neighbourhood on the present occasion.

Another clutch of 3 eggs, slightly incubated, of this bird have since been brought to me by a *shikari*, who found them on the 25th March, on stoney ground dotted with bushes at the southern base of the Salt Range, within the limits of the village of Kandwal.

Jhelum, H. W. WAITE, F.Z.S., M.B.O.U.,
31st March, 1925. *Indian Police.*

No. XVIII.—THE NESTING OF THE LITTLE GREEN HERON (*BUTORIDES STRIATUS JAVANICA*) IN THE DISTRICT OF 24-PERGANNAS

(*With a photograph*)



(Green Heron Fledglings)

Instances of the occurrence of the Little Green Heron throughout the district of 24-Pergannas that have come to my notice are so numerous that to call *Butorides javanica* a *rara avis* in this part of the country will be a travesty of fact. But the bird is very sparingly distributed and never abundant even in its favourite haunts. Although extremely sensitive to human intrusion, it is found to frequent tree-overshadowed tanks and jheels within a village. Treeless places and open stretches of cultivation with pools of water are never to its liking. Edges of tanks overgrown with jungle, low bushes and pendant leafy boughs overhanging the water are its hunting ground. Making its abode in the heart of a village, it so adjusts itself to its environment and regulates its activities as to escape detection altogether. Less nocturnal than other herons, it is active in the day time, but its movements are secretive and noiseless. It is unsociable to a remarkable degree, and I have seldom found more than a pair frequenting a particular place. It is in its breeding season that villagers get some remote chance of discovering its existence. Its call, scarcely audible at other times is now heard and gives a clue as to its movement and flight which now centre chiefly round some village tank surrounded by large trees and dense foliage. Nidificatory duties compel the bird's frequent attention to and descent on the edges of the above tank where its prey is available.

Munn in his note on the Birds of the Calcutta District (The Ibis, 1894) records the occurrence of *B. javanica* in the neighbourhood of Calcutta in the district of 24-Pergannas, and at Mogra on the E. I. Railway which is in the district of Hooghly. But he says nothing as to the time of its nesting in these localities. Oates in the Fauna of British India (vol. iv, p. 396) mentions May to August as its nesting season in most parts of India. I was, however, fortunate enough to have several nests of *B. javanica* under my observation this year. I found the bird began nesting as early as March, and in April, I observed the young ones sufficiently grown up and fully feathered. To quote from my Diary :—

'March 22, 1925.—Locality : Debandipur, two miles roughly N. E. of Sodepur Railway Station : Nests with two eggs of *B. javanica* in a Tamarind tree (which now becomes bare by the shedding of its leaves) overhanging a village tank at a height of 30–35 feet. Inspected this nest again on April 22 and found two grown-up young fully feathered sitting by the nest and at our approach creeping and skulking along the branches. The latter are photographed on April 26.

March 27, 1925.—Loc : Village Nimté, off Belgharia due East. Stick-nest with a newly laid egg of *B. javanica* in a Mango branch (about 15 feet high) within a compound in the heart of the village ; a large tank near by. Inspected this nest again two days later, i.e., on the 29th and saw 3 eggs in it. Shot the hen bird in the legs and bagged her alive.

April 3, 1925.—Loc : Nimté, East of Belgharia Rifle Range. Another nest on a lofty mango tree near the site in which I discovered the nest of March 27 ; contains two newly laid eggs.

April 17, 1925.—Loc : Nātágar, a village of Sodepur : Stick-nest in a short mango tree overhanging a tank ; found the bird sitting on three eggs.'

I find that *B. javanica* raises a second brood not earlier than June, so that all nests of this bird that come to our notice between March and May contain, more often than not, their first brood. A slight structure of sticks, shallow but not without an appreciable depression in the centre, makes up its nursery, which is generally found in these parts of Bengal in branches of mango and tamarind trees overhanging or very near a village tank. Invariably in all the instances of nesting referred to I noticed the behaviour of the nesting couples (notably that of the hen) to undergo a remarkable change soon after the eggs were laid. At the approach of the climber they showed little nervousness, moved slowly up, when he was very near, to the next higher branch and stepped down to the nest again as soon as or even before the climber set his foot on *terra firma*.

CALCUTTA, SATYA CHURN LAW.
17th July, 1925.

No. XIX.—WEIGHTS OF WOODCOCK IN SHILLONG

In reading Mr. Stuart Baker's article on the Woodcock (*Scolopax rusticola*) in his *Game Birds of India, Burmah and Ceylon*, vol. ii, and noting that further information is required on the weights of Indian Woodcock, I send you the record for the 26 birds shot by me round Shillong in the past season, 1924–25.

The first 'Cock seen were on 14th October, 1924 and I shot a couple on 2nd April, 1925, the last I saw. In 1923 I shot one on 10th October.

8 ozs.	1	10 ozs.	3	11 ozs.	3
9 ,,	1	10¼ ,,	3	11¼ ,,	2
9¼ ,,	2	10½ ,,	1	11½ ,,	1
9½ ,,	3	10¾ ,,	2	12¼ ,,	1
9¾ ,,	1	— ,,	—	13 ,,	2

All the birds shot after the middle of March, which includes those over 12 ozs. weighed 11 ozs. and over.

The Woodcock has become a comparatively rare bird in the neighbourhood of Shillong mainly owing to the great increase in potatoe cultivation, which, according to the Khasi system, necessitates the cutting down and burning, for the sake of the ashes, of all undergrowth in the vicinity of potatoe, and to the fact that the fire paths, most of which happen to be near the best Cock nullahs, have been let out to cultivation. A bag of thirty Woodcock in the season would now be considered good and one has to go further afield to get even that number.

SHILLONG, G. R. ROW,
25th May, 1925. *Lieutenant-Colonel* (*I. A. Retired*).

[In April, 1925, we received a skin of a Woodcock from Lt.-Col. Sir Francis Humphrys, H. M. Minister, Kabul. The weight of the bird is stated by Sir Francis to have been 14½oz.—a very unusual weight for an Eastern specimen. *EDS.*]

No. XX.—RECORDS WITH SNIPE

I should like to invite your attention to the reference given by Mr. Stuart Baker (p. 558 of Vol. XX, Journ., Bombay Natural History Society) regarding the best snipe shooting by Mr. Cornish, then Superintendent of Police, Orissa. I wonder if you or any of the Members of the Society would kindly enlighten me whether this record has been beaten in India or elsewhere, even supposing the sportsman had the advantages of light, wind and ground and that he picked his own shots.

In his Game Birds of India (Volume II, page 67) Mr. Stuart Baker writes that Mr. Cornish's performance was the result of a bet of 25 to one that he could not shoot 100 birds with 100 cartridges, 10 to 1 that he would not get 96 and, 3 to 1 that he would not get 90. ' Mr. Cornish got upto his fiftieth bird without a miss, and eventually failed by exactly 4 birds to get his 100 birds in a 100 shots.'

The following are extracts from letters which I have written on the above subject to the Field which I include with a view to eliciting further information on this topic from readers of this Journal :—

' So far as my limited experience and observation carry me, I venture to think that in India the question of ground, wind and light plays a great part in the chances of success in snipe shooting.'

Ground—is one of the main factors for consideration in this connection. There are varieties of ground in India that we come across. In some places there are long stretches of paddy fields where a sportsman's foot will hardly go ankle-deep in mud or water—' easy walking ' with the kind sun behind and cool breeze, which so much helps the sportsman to feel his day's exertions less tiresome. What better conditions would a sportsman wish than these for his' ideal day ? '

In other parts of the country the picture is quite a different one, where a sportsman who is out for a day's shoot with some desire for a decent bag has often to cover a chain of tanks situated at some distance from one another. He has not only to do hard walking, often over rough ground, but at times just as the bird gets up before he finds his leg, all of a sudden, going into a waist-deep hole. He has sometimes to make his way through long, dry and thorny grass and weeds as high as himself and to make matters more ' sportive,' he has the bright Indian Sun shining clear on the sheet of water in front of him to dazzle his eyes and generally cause him to miss his bird. Those sportsmen who have the experience of an Indian Sun will, I am sure, bear me out that the Indian Sun if he liked, could be unpleasant to a sportsman on any day, even in the cold weather, if the wind got absolutely still.

All these things go to make ' walking ' heavy and tiresome, especially where there is no ' Kachha ' or fair weather road between the tanks so that they could be negotiated either by a motor car or a country bullock cart ; the sportsman has to walk the whole distance.

Wind—is not a small factor. Every sportsman knows how a right ' kind ' wind can help to make his chances of the day successful and how, if it chose to be unkind, it can reverse them. I mean high cold wind accompanied by winter rains and bad light.

I have already said enough about the light elsewhere and I do not propose to make special mention of its effects in determining the chances of good sport.

In fact prospects of snipe shooting, whether for ' average ' or sport largely depend on the above three chief conditions.

I give below extracts from old pages of my shooting Diary :—

In 1908 I got 24 snipe for 33 cartridges.
,, 1914 ,, 40 ,, ,, 61 ,,
,, 1922 ,, 52 ,, ,, 122 ,,
,, 1923 ,, 59 ,, ,, 102 ,,
,, 1924 ,, 25 ,, ,, 65 ,,

I can attribute these good days only to the sun, wind and ground being favourable to me and, though last but not the least, also to the snipe being kind to me on those days.

The Palace, Dhar, C.I.,
27th May, 1925.

UDAJI RAO PUAR

No. XXI.—THE SNAKE *NATRIX VENNINGI* (VENNING'S KEELBACK)

A CORRECTION

In looking into my note-books I find that I committed an error when describing this snake in this Journal (vol. xx, p. 774), which should have been rectified long ago. I recorded the costal scales as 19 at midbody, whereas they are normally 17 in the whole body length. In four out of ten specimens the rows reduce to 16 before the vent. They hand-list (vol. xxix, p. 601) calls for the same correction.

MAYMYO, F. WALL,
10th August, 1925. *Colonel.*

NO. XXII.—TWO COMMON 'FIRE FISHES' OF MADRAS (*PTEROIS RUSSELLII* VAN. HASS.) AND (*P. VOLITANS* LINN.), A PRELIMINARY NOTE ON THEIR VARIATIONS

During my stay at the Madras Aquarium, with which institution my official connection lasted for over four years (1919–1923) the fire-fishes, sometimes referred to as Scorpion Fishes, had always attracted me not only by their movements but also otherwise. Many of their characters seemed to vary so greatly as to make me think it was just possible that the validity of the two species may not stand rigid tests. The results of an enquiry in the course of which thirty-seven Madras specimens besides two from Tuticorin, one from Cochin and one from Ganjam were examined are set forth in this preliminary paper, along with a few other observations on these fish.

These somewhat conspicuously colored fishes are among the most striking residents of the aquarium. They are brought to the aquarium by line-fishermen who go, for fishing, to some 'pars', hard rocky banks, four or five miles off Madras. Their Tamil and Malayalam name '*thumbi*' refers to the insect-colored markings. As the body in the case of our two species is generally reddish with vertical brown bands alternating with paler ones they are named '*Senthumbi.*' With their elongated finrays, inter-spinous and inter-radial membranes and other leafy outgrowths simulating seaweeds, these flags, etc., are perhaps responsible for the Telugu name *Kodipunjulu*—they look like stones docked with fluttering weeds especially while in their favourite posture of floating listlessly, displaying no perceptible signs of movement. The apparently undue development of the fins misled the ancients to believe the fish was able to fly. Hence the name flying dragon, as also the specific name *volitans.* They are normally very lethargic and when they do swim they do so very slowly, with halts at frequent intervals. Even while sailing, the only movement seen is the gentle quiver of the fins. When disturbed, tred upon or otherwise touched, the lethargy vanishes ; the dorsal fin is erected as if in obedience to the order 'Carry swords' and the fish viciously strikes the intruder either upwards or sideways apparently with all the force at its command. It directs its blows with an accuracy which will do credit to a champion game-cock. The wounds show inflammation and cause acute pain. Of the three dangerous residents of the aquarium, the seasnakes, the catfishes and the firefishes, the last is the most dreaded and the aquarium coolies are very chary while cleaning the firefish tank. During my tenure of office at the aquarium, one cooly was unfortunately stung by a *Pterois.* As soon as he was stung he said he felt as if his foot, where he was stung, had suddenly come into contact with flaming fire—hence the name firefish. The wound which was linear in form, all the spines having run their tips along the same furrow, bled profusely for a short while only. With the stoppage of bleeding he did not feel very uncomfortable and managed to walk home. About an hour later his foot became swollen and the slight pain which he compared to that resulting from a scorpion sting—hence the name scorpion-fish—assumed intense proportions. He was taken to the hospital for treatment and was able to resume his duties on the third day.

All the twelve dorsal spines are grooved the terminal portions being deeply so. The groove is lined by a tubular duct which leads from a pear-shaped gland located at the base of the spine, and opens out at the tip. From the glands a milky white fluid may be squeezed out.

One specimen in the aquarium after some days of 'gas eye' lost its left eyeball. After some months the socket was healed, though empty to such an extent as to get even the colored band to run across it as of old. This made it well-nigh impossible for observers, casual or otherwise, to detect the absence of the left eye.

Scorpion-fishes occupy in the aquarium a tank with the anglers (*Antennarius* spp.) which are spoonfed by a long-reed with a piece of fish transfixed at the tip being dangled over their heads. The philosophers however take a long time to make up their minds and, more often than not, a firefish pounces on the morsel and snatches it away. Once an angler (*A. hispidus*) 5·6″ in length died in an unsuccessful attempt to swallow a firefish as long as itself. The operation which ended fatally to both the performers stopped when the jaws met the base of the dorsal and pectoral fins which were erect and spreading. The two were found thus interlocked the next morning.

Of the 37 Madras specimens examined 23 were *P. russellii* and the remaining 14 *P. volitans*. The 2 Tuticorin specimens and the one from Ganjam belonged to the species *volitans* while the one from Cochin was *P. russellii*. From the finray formula and the proportionate measurements of head, eye, etc., worked out, the range of variation may be given as follows :—

Pterois russellii.—Branchiostegals 7, Dorsal 12|1/11–12, (12|1/11–12) Pectoral 13 (13), Ventral 1/5, Anal 3/7–8 (3/7–8), Caudal 14 (14), Lateral row 71–75/64–68 (71/66), Lateral transverse 11/30–33 (11/33), Pyloric caeca 3, Length of head : Length of body : 3·7–4·4 (4) Height of body : Length of body : 3·5–4·2 (4) and Diameter of the eye : Length of the head : : (4·4½–5) (4½–5).

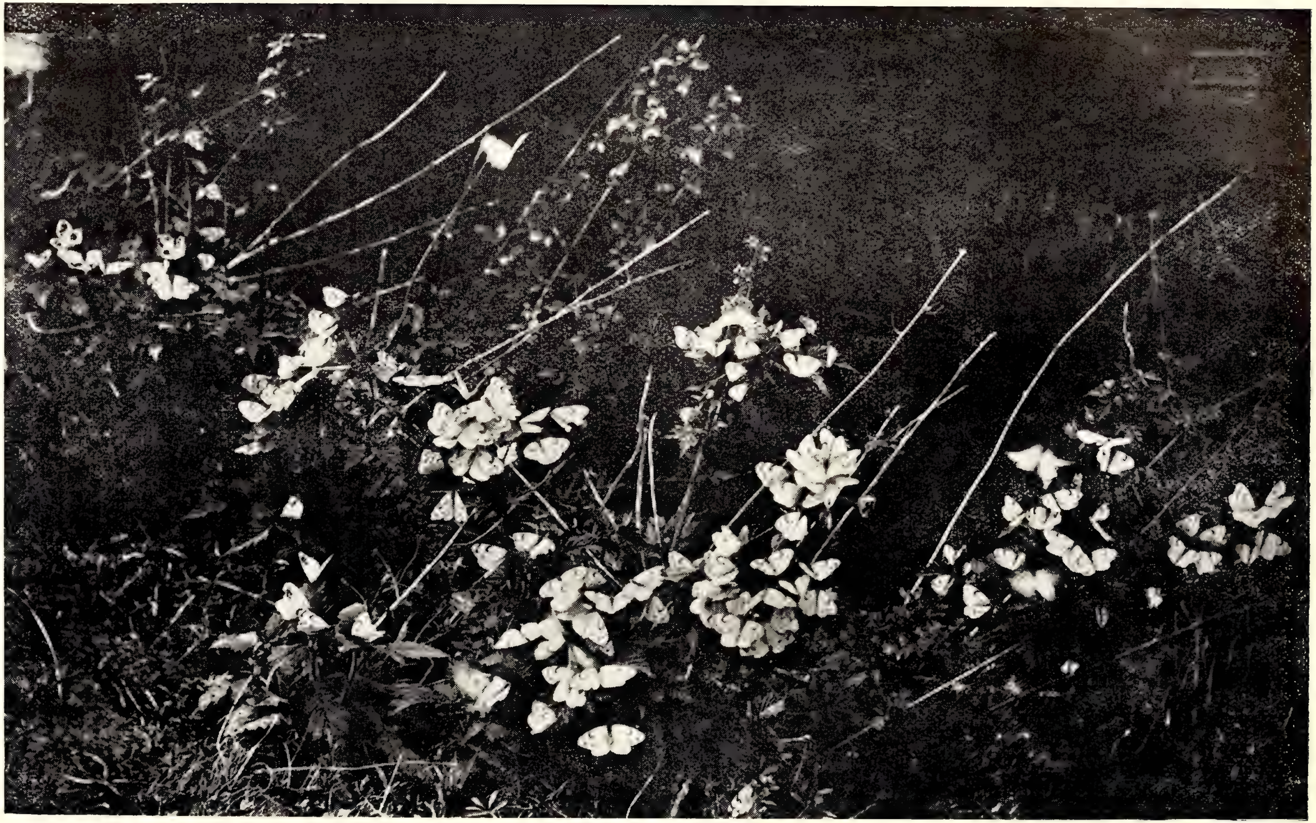
Pterois volitans.—Branchiostegals 7, Dorsal 12|1/10–11, (12|1/10–11), Pectoral 14, Ventral 1/5, Anal 3/6–7 (2–3/7–6), Caudal 14, Lateral row 89–94 (90) Lateral transverse 13/89–174 ? (13/—). Phyloric caeca 3, Length of head : Length of body : : 3·4–4·6 (3·6–4·3) Height of body : Length of body : : 2·8–3·5 (3–3·3) and Diameter of the eye : length of the head : : 4–4·5 (4–4·5).

Dr. Day's figures, taken from his volume II of Fishes of the 'Fauna of British India' series, are given in brackets. It will be seen that the finray formula is a constant factor, but that the proportion of the height of the body to its length is very variable. The shape of the body depends upon the size which is of course a question of age. The spots on the caudal fin form another variable future. The 23 Madras *P. russellii* ranged in size from 4″ to 9½″. Eleven (4–6″) had the caudal fins unspotted but 7 (5–8″) had the caudal fins unspotted except on the edge while 5 (7–9½″) had them spotted. The one partially swallowed by the angler had it unspotted. The Cochin specimen, 5″ long, had the caudal fin unspotted. Of the 14 Madras specimens belonging to the species *volitans* 11 had the caudal fins spotted. Of these one was 13″ and the others ranged from 5–10″; 3 which were 4, 4 and 4·5″ had these fins unspotted. The 2 Tuticorin specimens which measured 4 and 4·2″ and the Ganjam one which taped 5″ had the caudal fins spotted. Thus one characteristic used by Dr. Day to separate the 2 species is seen to be very variable. One impression left on my mind is that young fire-fishes, though without spots at first, developed the spots later as growth progressed. I am however unable to definitely assert it since no fishes were marked and this statement verified. But this is supported by the fact that the unspotted ones are invariably the smaller-sized fishes and the spotted ones the larger. It is indeed curious that color pigments absent early in life should develop later, as in the many examples I have come across at the aquarium, for example *Lutianus flavocaeruleus*, a blue fish with yellow fins and yellow jaws which gradually drops the yellow as it grows, or *Lutianus sebac* whose bright crimson bands fade as the fishes grow older, the reverse holds good. The angler fishes (*A. hispidus*), however, which are dull yellow with brown spots and streaks, assume brighter hues as they increase in size. But this is a case of mere intensification and not the development of new pigments.

MADRAS FISHERIES DEP., CALICUT, S. T. MOSES,
8th April, 1925. *Zoological Assistant.*

No. XXIII.—A RUN OF FISH ON THE STREAMS FALLING INTO THE YAMDROK TSO

When crossing a bridge over a small fall from a smaller lake into the Yamdrok Tso, I noticed numbers of fish jumping up the fall much as salmon do. The fish ran to about ¾ of a lb. weight and were all very much the same size.



A Butterfly Swarm

The next day at Pete Dzong, we noticed a similar thing : a stream 5 or 6 yards wide had overflowed its banks owing to heavy rain, and the overflow fell into the lake by a separate stream. During the night this overflow ceased to run and in the early morning we found the overflow stream dried up except for a few pools. The stream bed was littered with thousands of dead and dying fish, while the few remaining pools were packed with fish so that they could not move. I made the villagers fill baskets and also their coats with the fish, which were not quite dead and, in this way, had hundreds carried back to the stream and ake, The fish were all about to spawn, and it was curious to see that the instinct to go up the stream was so strong that almost dead fish on being put into the stream, instead of resting in the stiller water, immediately joined the rush to go up. We noticed that all streams were crowded with fish going up, and at stiller places near the banks they were so massed that they were almost pushed out ; so thick were they that a marauding dog was able to take a fish out of the mass and eat it on the bank. Hundreds of Brown-headed gulls (*Larus bruneicephalus*) were taking advantage of this state of affairs, but curiously enough the gulls only eat the heads, leaving the bodies lying about, ravens and village dogs were also feeding on the dead fish.

The Tibetan explanation was that at the head of each stream was a ' snow frog ' who fertilized the spawn of the fish.

Specimens have been identified by Dr. Hora of the Indian Museum as *Schizopygopsis younghusbandi* and *Nemachilus tibetanus*.

GANGTOK, SIKKIM, F. M. BAILEY,
5th November, 1925. *Lieutenant-Colonel.*

No. XXIV.—EXTRAORDINARY DISPLAY OF '*LEUCODICE SORACTE*' OF THE GENUS '*APORIA*.'

(*With a Plate*)

The accompanying photograph shows masses of this butterfly clustering on a common plant growing by the Himalayan roadside leading from Dalhousie to Chamba, at about nine thousand feet elevation. The sky was also full of them —so much so—that they looked like snow-flakes.

Curiously enough, at the same time as I took this photograph I caught the only two examples I possess of *aporia agathon phryxe* (Bdr.) of the same genus. The *A. leucodice soracte* appeared in May ; but by June seemed to have totally disappeared.

The various species of this genus evidently display the same characteristics— For Pallas tells us a similar story with regard to *A. crataegi* (Linn.), as he observed them in Siberia. I might add that I carefully noted at the time there was no single instance of any bird attacking them, though there were some birds about.

In England in 1923 similar scenes, but on a smaller scale perhaps, occurred with *rapæ* (Linn.) of the allied genus *Pieris*. For here too the sky was full of them—equally so on the hill tops, 400 feet high, as over their usual haunts.

Luckily, however, for our gardens, nature seems in the case of *rapæ* to compensate for the unusual numbers of the butterfly by a corresponding scarcity of its larvæ in the following year, for there were very few larvæ in 1924.

I shall be interested to hear whether this is equally true of the species of *Aporia*, and whether the scene in the photograph is of usual occurrence or not.

TIPTON ST. JOHN, DEVON R. Y. A. MORSHEAD,
9th February, 1925. *Late 4th Devon Regt.*

Col. Evans has written the following comment on the above note :—

In 1919 when I first went to Murree, the same butterfly was at the same game in early May—just like a fall of snow on the Mall. I have seen trees covered with butterflies, also patches of damp sand, but never in masses in the air like *soracte* ; *soracte* only flies for a month, when the horse chesnut is in bloom, and at the end of May dead bodies are found all over the place. It is certainly a protected species—very flimsy and slow flying.

I cannot vouch for the larva theory. The larva of *A. l. soracte* feeds on *Berberis lycium* and is brown with fine soft hairs all over it. Numbers of them can be seen on the foot plant. [*EDS.*]

No. XXV.—*COPTOSOMA OSTENSUM*, DIST. AND ITS ENEMY *SYNIA MELANARIA*, MULS.

In the arboretum established in front of the Agricultural College, Coimbatore, there is one particular *Palas* tree (*Butea frondosa*) out of several planted therein, that has been observed to be specially subject to an infestation by a small Pentatomid bug—*Coptosoma ostensum*, Dist. These insects have been found breeding continuously during the past three years on this particular tree and have sometimes been found crowding on the undersurface of the leaves in big swarms and causing them to dry up. It is rather curious that they should have shown a peculiar attachment to this particular tree all these three years, for there are other specimens of *Butea frondosa* very near on the Estate which have not been attacked up to the present. Young nymphs were introduced on another tree near by and throve on it, but subsequently when they became adults they were found to leave the tree, so that no specimens of the bug were noticed on it later in the year. This curious phenomenon appears to me to be inexplicable and is well worth investigation, perhaps from the chemical or physiological point of view.

The adult bug is small, somewhat rounded narrower anteriorly than posteriorly. Elytra yellow with black reticulations, scutellum with a narrow yellow transverse band and a pair of median black dots. Prothorax yellow with a black line on either side. Head yellow : eyes black and anterior ; the antennæ four-jointed, yellow, rising from under the eyes. Ventral surface black ; openings of the stink glands black, eyelike. The proboscis sharp and yellowish orange. The legs yellow. In the male the genital organs appear as a pair of stylets enclosing a pointed rod, and in the female they assume the form of a depression with a semi-circular ridge. Individuals in copulation pair back to back as usual in most bugs.

The female bug lays a large number of whitish eggs singly on the underside of the leaf on either side of the veins. The eggs are oval in outline with a slight flattening at one end and have the characteristic sculptured lid of a Pentatomid egg.

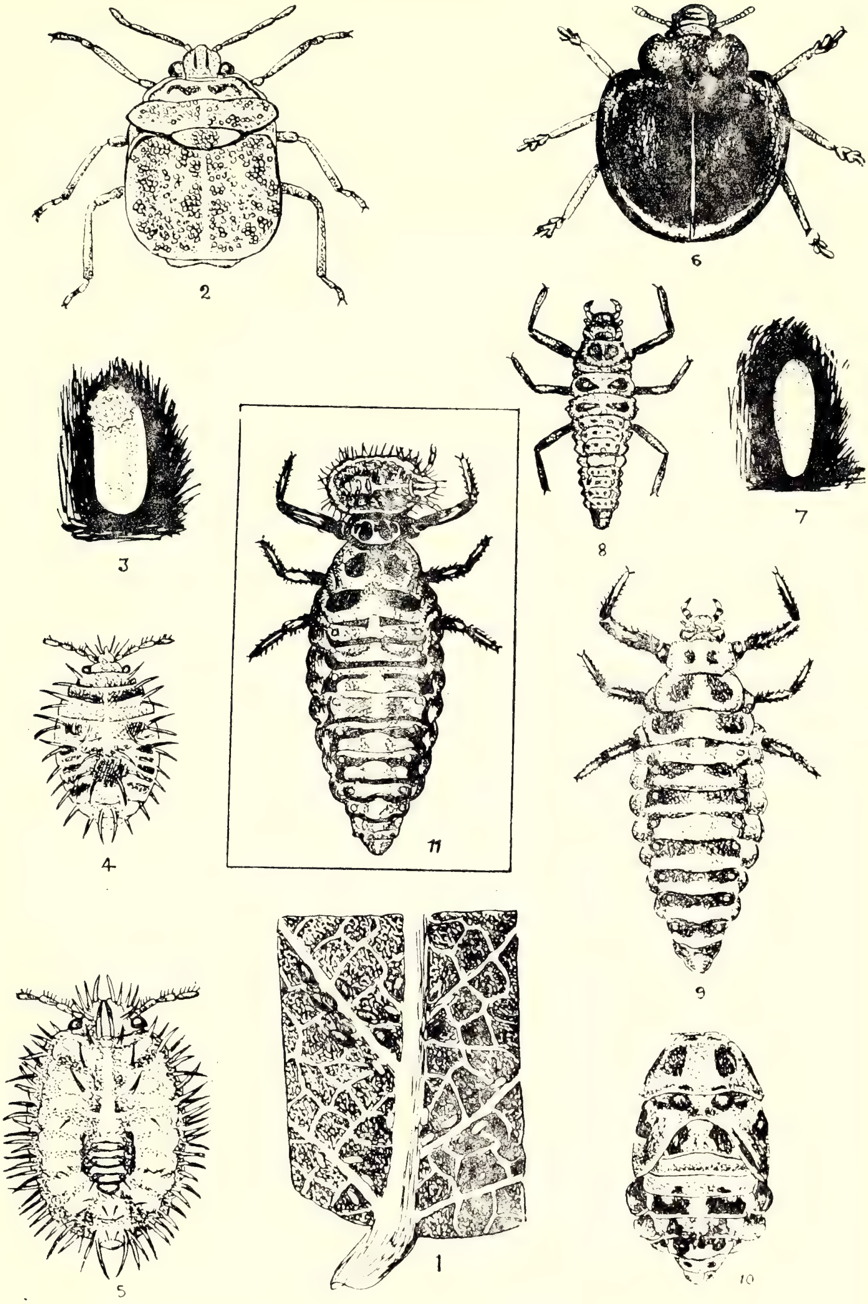
The nymphs emerge by pushing open the lid. They station themselves along the sides of the veins of the leaves for feeding. When just hatched they are small pretty creatures covered with a delicate pubescence all over the body, flattened in shape, and yellowish white in colour with one or two orange patches in the abdomen. The full-grown nymphs are dark brown and are also flattened and covered by brownish hairs all over the body. After the final moult the adult bugs emerge.

I am indebted to M.R.Ry. T. V. Ramakrishna Ayyar for drawing my attention to the presence among the nymphs of the bugs, of the grubs and adults of a certain Lady-bird beetle. I found that the beetle was *Synia melanaria* and that the grubs of this beetle were predaceous on the nymphs of the bug.

Lady-bird beetles are generally known to feed on Aphids, Scale insects, Thrips, etc., but so far as is known to the writer there is no record of a Coccinellid preying upon a Pentatomid Bug.

The adult of this predator beetle is black and almost circular in outline. Elytra, black. Prothorax, orange yellow and its lateral margins are produced forwards so as to encircle the prominent black eyes. Head yellow, mandibles orange, and the clubbed antennæ orange yellow. Ventral surface orange yellow, with the black edges of the elytra forming a ledge on either side. Legs orange yellow. There is no external character by which the sexes can be distinguished excepting the comparatively bigger size of the female.

The beetle lays eggs in groups of 10 to 15, placed on end on the underside of leaves infested with *Coptosoma ostensum*. The eggs are cigar-shaped, yellow and smooth—about 3 mm. in length and 1 mm. thick in the middle ; they turn orange the second day and on the third day hatch into tiny greyish black grubs with a white line across the body posteriorly. They have a flattened body slightly convex dorsally, tapering towards the hind end and covered all over by short black hairs. They are about 2½ mm. in length and have well-developed greyish legs. The ventral side of the body is lighter in colour. As soon as they hatch out they begin to run about and feed on the nymphs of the bug. After two days they undergo their first moult ; during this process they fix


2
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Synia melanaria, Muls., Predator on *Coptsoma ostensum*, Dist.

(*For explanation see reverse.*)

SYNIA MELANARIA, MULS.,

Predator on

COPTOSOMA OSTENSUM, DIST.

Explanation of the Plate.

Fig. 1.	Coptosoma ostensum, Dist.—Portion of Butea leaf showing eggs and nymphs.		
,, 2.	Do.	Grown-up nymph	(enlarged).
,, 3.	Do.	Egg	(do.).
,, 4.	Do.	Young nymph	(do.).
,, 5.	Do.	Grown-up nymph	(do.).
,, 6.	Synia melanaria, Muls.	Adult beetle	(do.).
,, 7.	Do.	Egg	(do.).
,, 8.	Do.	Young grub	(do.).
,, 9.	Do.	Grown-up grub	(do.).
,, 10.	Do.	Pupa	(do.).
,, 11.	A group of Synia melanaria preying on a nymph of Coptosoma ostensum. (enlarged).		

themselves to the surface of the leaves or any other support by the tail end and undergo a moult, the skin splitting open longitudinally along the back. Soon after a moult the legs appear brick-red and are held straight. The head appears likewise to be brick-red. The grubs are 5 mm. long, the prothorax pinkish with a median black patch, the rest of the thorax black with a white longitudinal patch, the abdomen banded with white intersegmentally. The grubs feed voraciously during this and the subsequent stages, burying their jaws into the abdomen of the nymph from underneath, and when the grub finishes feeding the skin of the prey is left intact, so that it looks as if the nymph had been completely sucked dry. The grubs undergo three more moults. After every moult they grow in size and the white markings on their body become more and more pinkish until, when about to pupate, they are nearly 8–10 mm. long and correspondingly stout and all the white markings are completely red.

About 9 days after hatching, the grubs attach themselves to the leaf or some other support by their tail ends and transform themselves into pupæ which are more or less round and about 5 to 4 mm. in size. They are pinkish red in colour. The head has two longitudinal black streaks and the thorax two pairs of black dots along the median line and one on either side along the edges. The abdomen has two longitudinal black median streaks and a cross line on either side anteriorly extending up to the outer margins.

In 6 or 7 days after pupation the adults emerge ; during this process the pupæ undergo a few convulsive movements whereby a break in the pupal skin occurs in the middle just behind the thoracic region and the adults emerge by pushing asunder the two halves of the pupal skin. The freshly transformed adults look entirely red in colour but gradually the colour of the elytra begins to darken and becomes completely black in the course of a day. The adult beetles have not been found to feed on the bugs, but judging from the habits of other predaceous Lady-bird beetles it is likely that they too may be predaceous.

AGRICULTURAL COLLEGE,
COIMBATORE.

T. V. SUBRAMANYAM, B.A.,
Assistant in Entomology.

WANTED : INFORMATION ON INDIAN LEECHES

The undersigned is desirous of bringing together as complete information as possible relating to the natural history of Indian leeches for use in a volume on the Hirudinea for the 'Fauna of British India' and appeals to naturalists, medical men, sportsmen, stock-raisers and others for help.

Any data, whatever whether published or not, relating to any phase in the lives or activities of either land or aquatic leeches, or any specimens of leeches or their egg cases will be of value and any data published will be fully credited, of course.

Among the subjects on which information is particularly desired are the habitats, hosts or prey, breeding times and habits, length of life, enemies, effects of bites on man or other animals, relation to transmission of disease, economic importance, etc.

In connection with the *land leeches* we are particularly ignorant of the ecological relations of the several species, their manner of spending the dry season, breeding, the sense through which they detect the presence of their victims, the exact manner of using the sucker in locomotion, especially on herbage, etc.

Exact information concerning the life-history of the *cattle leech* which enters the nares of buffaloes, yaks, and other mammals is much wanted.

The undersigned will be pleased to correspond with any one able to furnish any such information.

J. PERCY MOORE,
Zoological Laboratory,
University of Pennsylvania,
Philadelphia, Penna.

PROCEEDINGS

Proceedings of the meeting held on July 22, 1925

A meeting of the members of the Bombay Natural History Society and their friends took place on Wednesday, Mr. P. M. D. Sanderson presiding.

The following 36 new members were elected since the last meeting :—Major J. W. Gordon, Jodhpur ; Mr. M. S. Tuggerse, B. F. S. Karwar ; Mr. S. Campbell, Saklipur, Murshidabad ; Mr. J. D. Lewis, Bombay ; Capt. A. J. Hemmons, Bassein, Burma ; Mr. A. J. Jones, Moulmein, Burma ; Mr. F. V. Evans, Europe ; Mr. C. W. G. Morris, Attikan, Mysore ; Mr. Albert Sherriff, Europe; Mr. L.C. Oliver, Attikan, Mysore ; Mr. I. A. Ingram, Khanewal, Punjab; Capt. A. W. Ibbotson, M.C., M.B.E., I.C.S., Ghazipur ; Mr. L. E. Saunders Koraput, Vizagapatam Dist. ; Mr. C. E. Capito, O.B.E., M.I.C.E., Bushire ; Mr. J. K. Swaine, Matang, F.M.S. ; Mr. J. C. Laidlay, Europe ; Mr. A. M. Rogerson, Rangoon ; Mr. E. O. Sampson, I.F.S., Satara ; Mr. J. H. Lindsay, I.C.S., Calcutta ; Mr. John H. Barnsley, Cocanada, S.I. ; Major F. C. Hickie, I.A.S.C., Quetta ; Mons. Jean Delacour, France ; Capt. E. H. P. Jackson, R.H.A., Meerut ; Capt. F. W. Hasweil, Bombay ; Madamoiselle F. M. d'Orle, Udaipur ; Capt. F. O. Cave, Peshawar ; Mr. D. J. Atkinson, I.F.S., Insein, L. Burma ; Mr. A. Forrington, Bombay ; Mr. E. S. Hartnoll, I.F.S., Moulmein, Burma ; Mr. T. H. O. Collings, Delhi ; Mr. P. J. Murphy, Bengal ; Mr. S. W. Walton, Bombay ; Capt. Wm. Bird, R.A.M.C., Simla Hills ; Her Highness Maharani Akhand Saubhagyavati Laxmi Bai Saheb, Puar, Dhar ; G. N. Richmond, Bhamo, Burma ; Rao Gopal Sinha Rathor, Ajmer.

Improvements to Galleries

Mr. P. M. D. Sanderson, the Honorary Secretary, drew the attention of the members present to the improvements that had been made in the galleries of the Natural History Section, Prince of Wales' Museum. A recent addition to the mammal gallery is a beautifully mounted example of the Kashmir stag presented by Col. Burton and set up in the Society's laboratory. The Kashmir stag makes perhaps one of the grandest trophies that is possible to obtain in India and the specimen exhibited carries a very fine spread of horns. The Curator has been doing his best to improve the lighting and ventilating arrangements in the galleries. The exhibits suffered very greatly from cross lighting and reflections, but by screening off the lower portions of the windows and cutting off direct light a great improvement has been effected. A notable addition to the Bird Gallery is a nesting group of night herons. Night herons are quite common birds in Bombay, but they are not generally seen as they fly after dark. During July and August they breed in colonies on large trees and there are quite a number of such colonies in Bombay. The group in the museum faithfully reproduces the nesting site of a pair of night herons. The parent birds and young are shown while a young night heron in immature plumage occupies the background. The group is one of a series which the Curator hopes to prepare to illustrate the nesting habits of Indian Birds. Those present inspected a very fine Bison head which was mounted for one of the members of the Society by Mr. McCann in the Society's laboratory.

Animals of the Past

Mr. Prater the Curator, gave an interesting lantern lecture on 'Animals of the Past' illustrated by a series of very fine slides. The lecturer after explaining how fossils came to be formed, proceeded to trace the history of animal life from the earliest known fossil forms to those of more recent origin. He explained that the earliest known fossils were those of highly developed animals and that practically all traces of the lower organisms which preceded them had been lost. He explained how the earth and the seas were ruled by successive races of creatures who held sway for a certain period and then perished and became extinct. Thus in the sea the bony armoured fish gave place to the sharks and these in turn gave way to the great Marine reptiles. These had their day of several thousand years and then perished. The lecturer illustrated the earliest known type of fossil birds and showed that in their structure, particularly in the earlier types-Birds show evident traces of their reptilian ancestry. He came finally to the last group of animals—the mammals which culminated in man. The lecturer referred to the various animals which were co-existent with man in primitive times. Among these were the horse, the mammoth and the reindeer. The mammoth he explained was probably the great great grandsire of the modern Asiatic elephant and we could trace the ancestry of the elephant back through a series, of stages to the earliest known form, the Meretherium, a small pig like animal with a long, bony face and quite normal teeth.

A DIFFICULT QUESTION

The question as to why animals became extinct was a very difficult one to answer. In some cases a species did not become extinct at all. It was merely replaced by other species more adapted to survive in changing conditions. Then there were creatures like the gigantic extinct reptiles, who were so highly specialized that they were unable to respond to conditions of change however slight and so they perished and yet again we have creatures like the great marine reptiles who were quite as adapted to their condition of life as our whales are to-day and yet these died out. Why ? We do not know. It was formerly customary to ascribe the extinction of creatures to great catastrophies such as earthquakes, volcano eruptions, etc., but it is conceded that these must have been purely local in their effect. Man has, however, been a great instrument in the extermination of many species. He destroys animals, takes away their food and cuts down their forests and literally drives them out of existence but at the same time we must remember that the greatest changes took place long before man even came into existence. These are some of the various explanations put forward, but it must be remembered that they are merely conjectures. As Dr. F. Lucas tells us in his 'Animals of the Past'—"Man is an animal that wants to know the why and wherefore of everything and he cannot rest content until he has formulated some theory to explain the many problems before him and hence from his knowledge of apparent fact he formulates a theory to explain the extinction of various creatures which has been taking place ever since living beings came into this world and were pitted against one another and against their surroundings in that ceaseless struggle for existence which has waged since the dawn of time'.

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